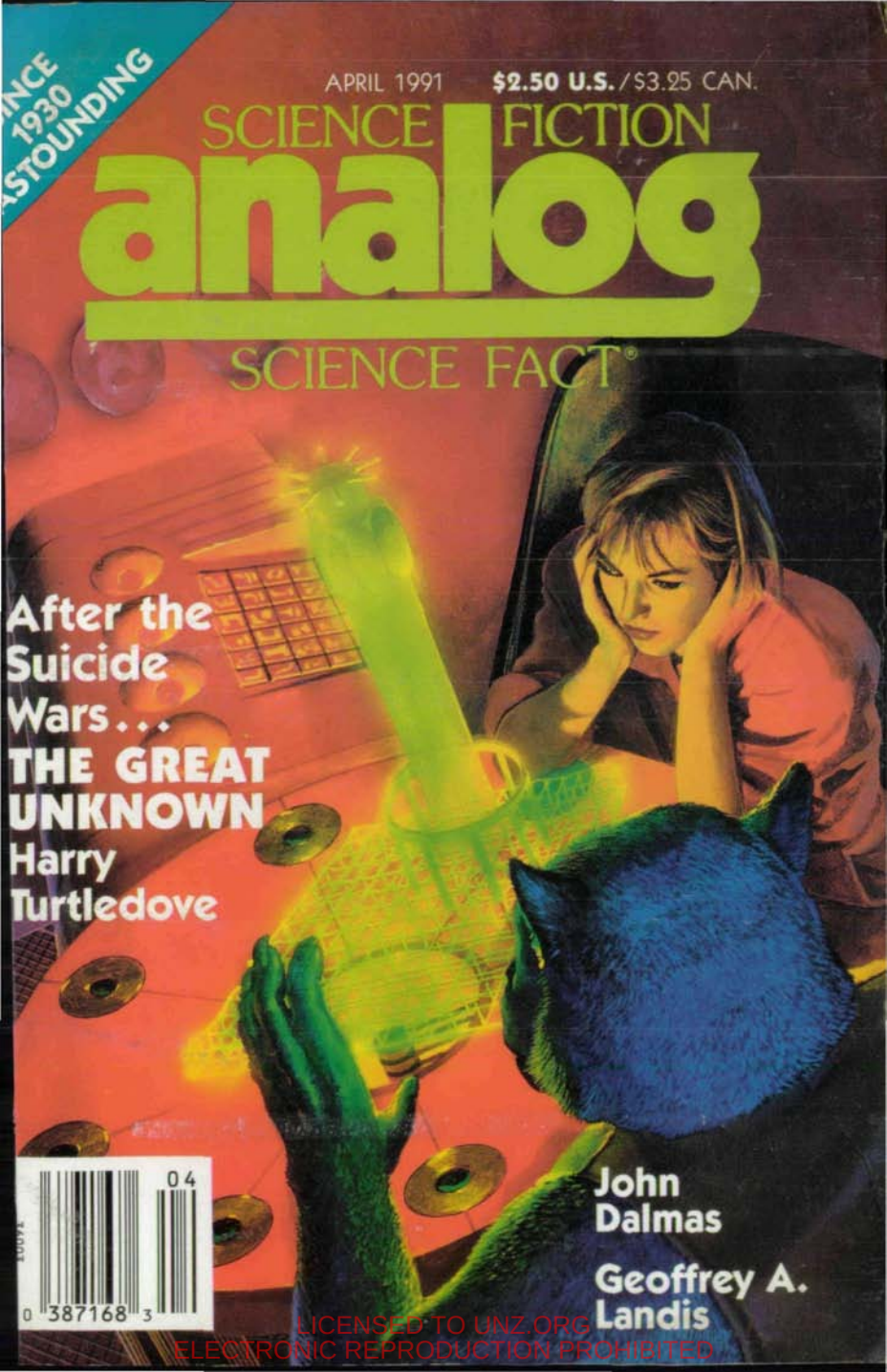

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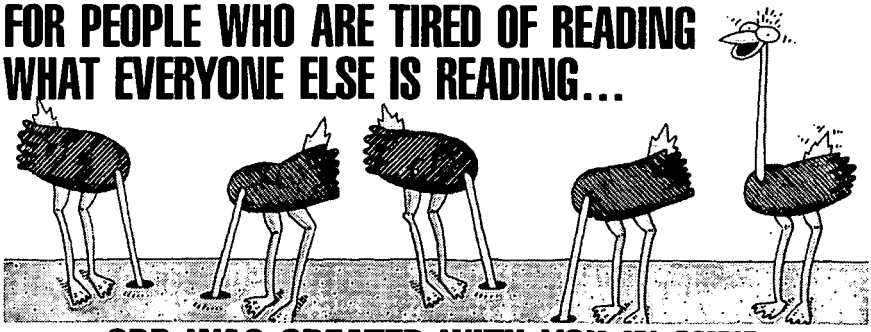

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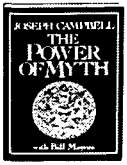

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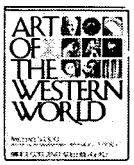

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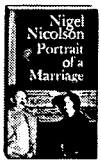

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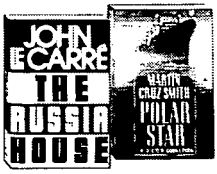

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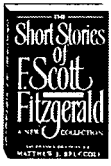

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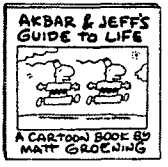

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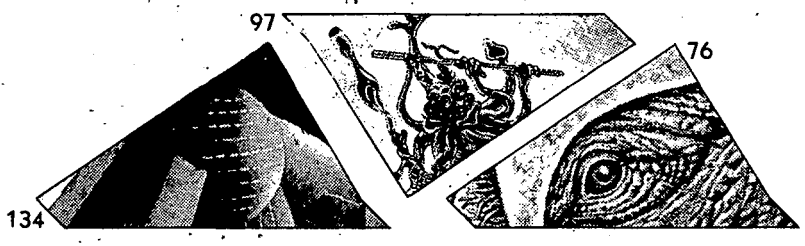

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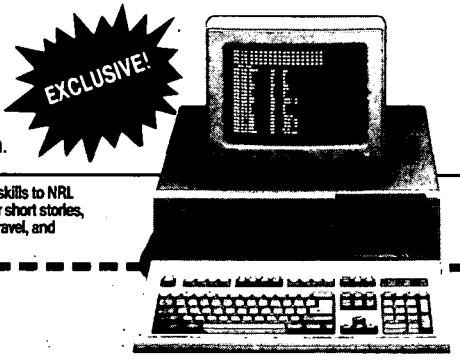

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Editorial

EX MACHINA

Stanley Schmidt

It's no secret that in recent years the cost of medical treatment in the US has been increasing at a rate far exceeding general inflation. Nor is it a secret that a major reason for this disproportionate increase has been an epidemic of successful malpractice suits in which patients were granted astronomical sums for real or fancied damages at the hands of doctors. Some of those damages have been real, of course, but in many cases the awards were far out of proportion to actual injury; and in others they were unreasonable simply because they were based on unrealistic assumptions about what doctors can be expected to do with present knowledge. The result is that doctors have found it necessary to carry huge amounts of malpractice insurance, and to pass the cost of the premiums on to their patients. One result of *that* is that patients have become increasingly unable to pay for treatment they need, and reluctant to seek even diagnosis when they should.

I've commented on this before ("Infallibility Required," in *Analog*, June 1984), but today I want to return to it from a different angle. A year or two ago Jay Kay Klein mentioned an idea for dealing with the problem which I think is worth passing on for your consideration. All credit for the basic concept is his, and I offer my apologies in advance if my memory has not accurately conveyed the form in which he first presented it. In any case, by the time I finish I expect to be talking about my own version of it, and Jay Kay bears no blame for whatever faults *that* might have.

Other people have suggested that a solution to the problem might be to impose a legal limit on how much a patient can collect in a malpractice suit. If

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awards are capped, insurance premiums required to protect against them can also be brought down. This proposal was protested vehemently by lawyers and consumer advocates who believed that seriously wronged patients should be able to collect as much as a sympathetic court might allow.

Jay Kay's proposal has something for both groups. It allows doctors to keep their expenses down, and patients who don't expect to go after huge damage suits to afford normal medical care. It allows patients who think they deserve huge payments if something goes wrong to collect such payment.

The essence of it is this: shift the burden of malpractice insurance from doctor to patient. This is not as drastic a change as it sounds on first hearing, for under the present system patients are really paying the doctors' insurance premiums anyway. But under the new system, patients who think they're entitled to vast sums if the doctor makes a mistake can buy enough insurance to provide them. Patients with more modest ideas of what constitutes appropriate compensation can buy less. The paperwork can be made very simple (with an associated reduction in administrative costs). You know those vending machines in airports that sell flight insurance on a per-flight basis? Why not put them in doctors' and hospitals' waiting rooms? Let patients put in as many quarters as they want, to get the coverage they think they need!

Those lawyers who get rich off malpractice suits would fight such a proposal tooth and nail, of course. Patients who thought they deserved astronomical awards—who perhaps even secretly hoped for a minor mishap from which they could win an unearned fortune—would balk at having to pay more than patients who were willing to settle for less. People in a wide range of circumstances might object that such a scheme would reduce the whole business of medical treatment to a game of chance. But if it stirred up enough discussion, maybe when the smoke cleared more people would recognize that medical treatment has *always* been a game of chance, and some attempt should be made to run the financial part of it as a *rational* game of chance. Let the house odds bear a reasonable relationship to the real, statistical odds—and let those who hope for big winnings place big bets, just as they would at the racetrack.

A practical problem that would remain, even if a way could be found to overcome the opposition of lawyers not wanting to see a lucrative field fenced off, is this. What would such insurance cost, and what would be the corresponding reduction in amounts paid directly to doctors and hospitals?

The answer to that, I think, is inextricably bound up with the lawyers' opposition. As long as legislation and court practice continue to allow people to bring, and win, huge malpractice suits against doctors, the JKK proposal would achieve very little. Doctors would *still* have to pay enormous malpractice insurance premiums, the costs of which they would continue to pass on indiscriminately to all their patients. The waiting room vending machines would

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become little more than a new gambling device for a few patients with extra money and enough greed to hope for even more than they could get through the courts. To make the vending machine system work, it would need to *replace* at least a large part of the present system. That would presumably require legislation to at least severely restrict the amounts that could be awarded in malpractice suits, and that doctors could be charged for insurance against them. Getting such legislation adopted would, of course, face an uphill battle; but it's not inconceivable that such a battle could be won, if enough citizens decided it was worthwhile and organized their efforts to promote it.

And maybe it should go even further. The more doctors have to pay for malpractice insurance, the more they must charge patients. The greatest reduction in direct medical bills would come from shifting the insurance burden *entirely* to patients, cutting out the middleman (who presumably pads his costs before

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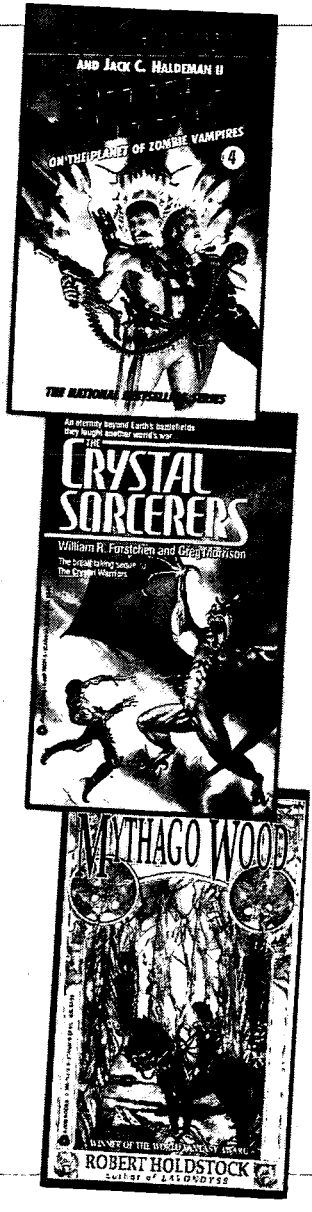

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passing them on to customers) and letting every patient choose (and pay for) as much or as little protection as he or she wants.

You might fear that shifting all or even some of the responsibility for malpractice protection from doctors to patients would remove one of the most important functions of the present system: quality control. A doctor who must fear being ruined by a malpractice suit if he does sloppy work has a strong motivation *not* to do sloppy work. If the vending machine insurance system were adopted, what sticks and/or carrots would exist to keep doctors in line?

The answer to that, I think, might well be provided by extending the racetrack analogy. Not all horses run at the same odds; the odds for each are set on the basis of its track record. A horseplayer with X dollars to bet can choose his horse. If he puts his money on a long shot, he stands to win a very large sum if his horse comes in—but that isn't very likely. If he bets on a favorite, he doesn't stand to collect as much, but he has a much better chance of collecting *something*.

The same could be true of those vending machines in doctors' offices, though the strategy would be a little different. Like any insurance, malpractice insurance is a bet most normal folks don't really *want* to win: you only collect if something bad happens to you. But the principle of basing odds on an individual horse's past performance, and choosing to bet on a good one, could carry over quite nicely. A doctor who habitually did things that led to successful claims would have that fact reflected in the high premiums charged for insurance by the machine in his office (which after all, are set by the insurance company, not the doctor). By the same token, the machines in the office of a consistently good doctor would charge lower premiums for the same services.

Such a system would, in fact, provide at least as effective a system as any now available for helping patients choose doctors. The premiums charged for insurance on their services would provide a pretty fair empirical measure of their competence and conscientiousness as demonstrated to date. What about new doctors? Their premiums could be based on statistical averages for new doctors—but would change as they gained experience, to reflect how satisfied patients were with their performance. Lousy doctors, or lazy ones, would *hate* such a system—but good ones might welcome the chance to have a visible measure of their superior performance. Patients to whom the possibility of an enormous court claim meant more than their health would be perfectly free to bet that health by going to a poor doctor and putting lots of quarters in the machine. Most people, I suspect, would rather get the double bonus of less expensive insurance and a high probability of better treatment—so a doctor who wants to stay in business would most assuredly have an incentive to keep the numbers on his vending machine favorable!

The proposal may be a bit outrageous—but considering the outrageous system we've already been living with for too long, it at least warrants consideration. ■

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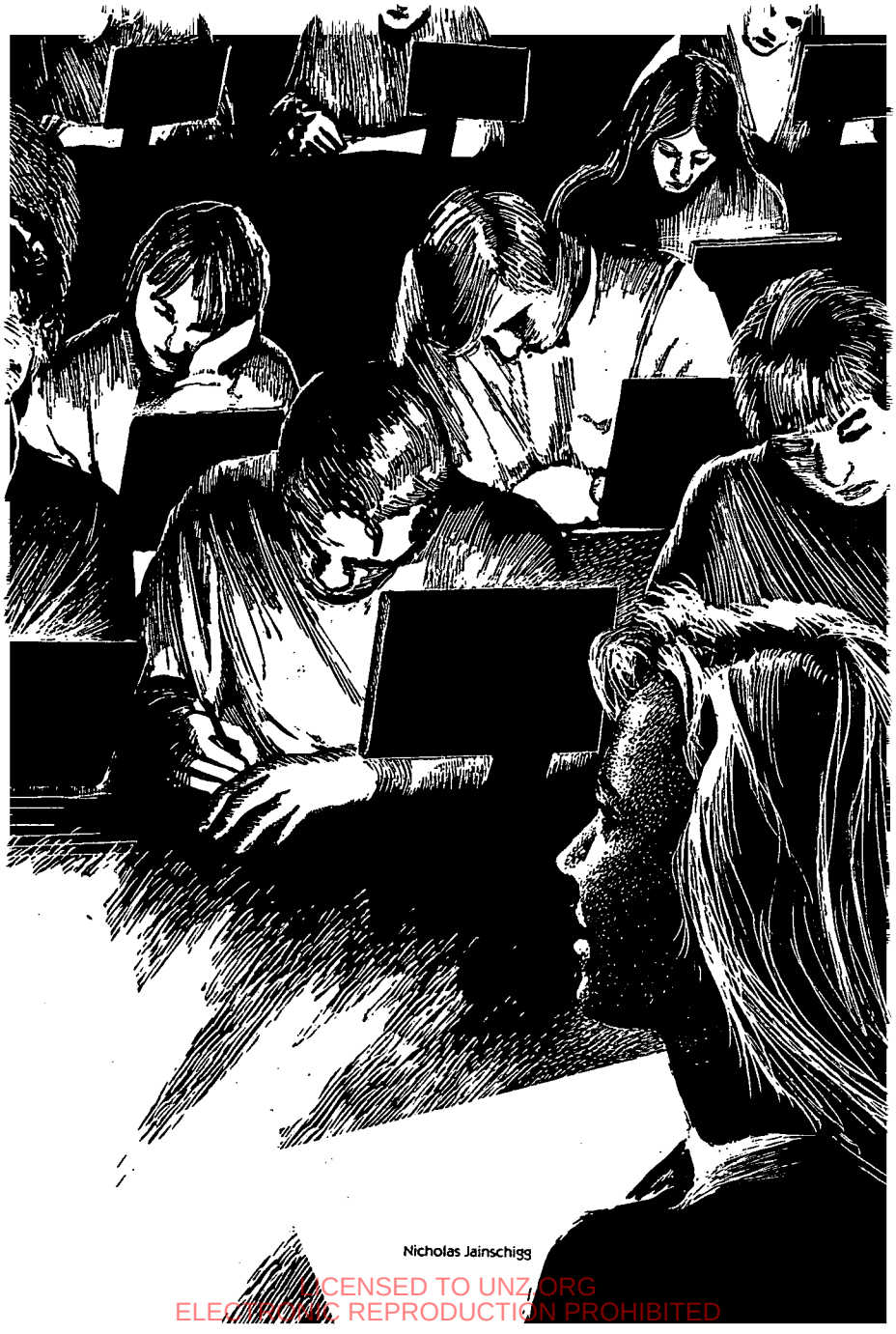

Nicholas Jainschigg

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Ali Bakhtiar glanced toward the clock. A dark, arched eyebrow rose. "Isn't your first class at 0930, Jennifer? You're going to be late."

"I'm almost ready." Jennifer Logan made sure one last time that she had all her notes. She took a couple of deep breaths, as if she were going to start lecturing then and there. "I hope the hall's well miked. My voice just isn't big enough to carry by itself."

Bakhtiar smiled encouragingly. "You'll do fine." When he looked at the clock again, the smile faded. "But you'd better get moving."

"Here I go." Jennifer ran a hand through her long blond hair. "Do I look all right?"

"That is a foolish question. You know you look wonderful." He stepped forward to kiss her; his hand slid down her back to cup her left buttock. He pulled her closer. The kiss went on and on.

Finally she twisted away. "You were the one who said I'd be late," she reminded him. She knew her looks drew men to her; she found that a nuisance as often as she enjoyed it. Living with Ali Bakhtiar the past year had at least given her an anchor. Seeing her on his arm kept a fair number of other men—not all, but a fair number—from pestering her. Even so, there were times when she wished she was still trading with aliens, to whom she was as peculiar as they were to her. It made life simpler.

But as she strode out of the apartment she and Bakhtiar shared, that sometimes wish vanished. This would be her third semester of teaching Middle English science fiction at Saugus Central University. She still had trouble believing that, after five years traveling the wilder reaches of the local arm of the Galaxy, she actually had the academic job she'd wanted all along.

Sometimes you'd rather be lucky than good, she thought as she hurried toward and then across the university campus. She'd been about to set out on yet another trading run when word of the opening at Saugus Central came over the datanet. The post would have been long filled by the time she got back, which meant she would have left on one more mission still, just to put more credit in her account. By the time the next job opening appeared, she might have been nearing master trader status. Master trader was all very well—after some years of trading, she knew it was a title that had to be earned—but she much preferred putting *assistant professor* in front of her name.

Saugus was a good planet for hurrying. The weather here in the foothills was cool and crisp, the gravity was only about .85 standard, and the air held a little more oxygen than human beings had evolved to breathe. The clock in the classroom said 0929 when she stepped through the door. She grinned to herself. Being late on the first day didn't make a prof look good.

She got to the podium just as the clock clicked to 0930. "Good morning. I'm Dr. Logan," she said—she didn't believe in wasting time. "This is Middle English 217: twentieth-century science fiction." Someone got up and left in a hurry. *In the wrong room,* Jennifer thought. Other students tittered.

"Can you all hear me?" Jennifer

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asked. Everyone nodded, even the students in the back of the hall. The miking was all right, then. Her voice was so light and breathy that it needed all the help it could get.

"All right. This course is part language, part literature. As you'll have noticed when you were registering, beginning and intermediate Middle English are prerequisites. Don't forget, the documents we'll be reading are a thousand years old. If you think you'll be able to get through them with just your everyday Spanglish, or even with an ordinary translation program, you can think again."

Someone else, a girl this time, walked out the door shaking her head. Jennifer felt the eyes of the rest of the class upon her. Most students muttered their notes into recorders with hushmikes. A few stroked typers or scribbled on paper in the ancient fashion; in every class, she'd found people who remembered better when they wrote things down.

A couple of male students hadn't started taking notes at all. She could tell what was in their minds as well as if she were telepathic. It annoyed her. Not only were they boys by her reckoning, but she'd been places and faced challenges they could hardly imagine. She knew they didn't care what she'd done. To them, she was only an attractively shaped piece of meat. That annoyed her even more.

She sighed to herself and went on, "That's not to say you won't find words—a lot of words—that look familiar. A lot of Spanglish vocabulary can be traced back to roots in Middle English. That's especially true of Middle English science fiction. Many, in fact most, of our modern terms relating to space flight come from those first coined by science-fiction writers. Remarkably, most of those coinages were made before the technology for actual space flight existed. I want you to think for a moment of the implications of that, and to think about the leap of imagination those writers were taking."

Some of them made the mental effort, she saw. She knew they were doomed to failure. Imagining what humanity had been like before space flight was as hard for them as willing oneself into the mind of an ancient Sumerian would have been for an ordinary citizen of the twentieth century.

She held up a sheet of paper. "I want to talk about the books we'll be reading this semester," she said. The back door to the lecture hall opened. She frowned. This was one of the times she wished she had a deep, booming voice. She hated latecomers interrupting her when she'd already started lecturing. She began, "I hope you'll be on time for our next—" but stopped with the complaint only half spoken. The new students were not human.

The whole room grew quiet when the three of them walked in. They were dark blue, and on the shaggy side. The door was more then two meters high, but they had to stoop to get under the lintel. The door was more than a meter wide, but they had to turn sideways to go through it. Their faces had short muzzles and impressive teeth.

"What species are they?" a student in the front row asked the fellow next to her. He shrugged and shook his head. Likely neither of them had ever been off Saugus before, Jennifer thought.

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She knew the aliens' race. Of all the places she would never have expected to meet Foitani, though, a Middle English class on a human settled planet of no particular importance to anyone ten light-years away came close to topping the list. Maybe, she thought, they were looking for the engineering department instead. She called, "How may I help you, Foitani?"

The three big blue creatures cocked their heads to one side, listening to the translator bugs each wore in one ear. One of them answered, speaking softly in his own rumbling language. His translator turned the words to Spanglish: "Apologies for tardiness, honored instructor. We concede the fault is ours; we will yield any forfeit your customs require."

"We will," the other two echoed.

"No—forfeits—are necessary," Jennifer said faintly. "May I direct you to the class you are seeking?"

The Foitan who had spoken first bared his teeth—or possibly hers; the differences between Foitani sexes did not show on the outside. Jennifer knew the gesture was the Foitani equivalent of a frown, but it made the alien look as though he intended to take a bite out of someone. She wished for the trader's stunner she seldom wore any more. The Foitan said, "Have we interpreted your symbology inaccurately? This hall is not for the teaching of Middle English two-one-seven?"

"You're—enrolled—in my class?" Jennifer heard herself squeaking, but couldn't help it. It wouldn't matter anyhow; translator bugs were fine for meaning, but they filtered out tone of voice.

"So we ought to be." the Foitan answered, his own translator sounding grave as usual. "Our funds were accepted, our names inscribed in your computer banks. I am Thegun Thegun Nug; here beside me stand Aissur Aissur Rus and Dargnil Dargnil Lin."

Jennifer shoved notes aside. "Enrollment," she muttered. The list appeared on the screen set into the top of the podium. Sure enough, the three Foitani were on it. Human names came in such bewildering variety that she hadn't especially noticed theirs. "Very well," she said, "sit down—if you have the reading knowledge of Middle English this course requires."

The Foitani sat. They weren't so much bigger than the average human as to make Terran furniture impossible for them—just enough bigger to be intimidating, Jennifer thought. Aissur Aissur Rus said, "We will meet the language requirements of the course, honored instructor. We are Foitani, after all. We are practiced in dealing with languages far more ancient and different from modern speech than your Middle English."

She knew that was true. "Very well," she said again, and began talking about the books she would be assigning. Never had she had such perfect attention from students on the first day of class. After the ostentatious if somber politeness of the Foitani, it was as if all her human students feared they would be torn limb from limb if they got out of line.

Because she didn't have to pause even once, she got through all the material she'd planned to present in spite of the delay the Foitani had caused. Only after the three big aliens left the hall did the

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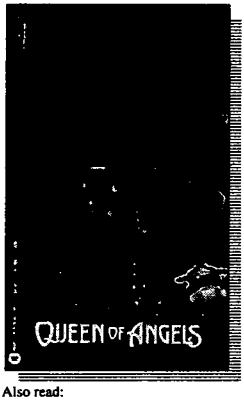

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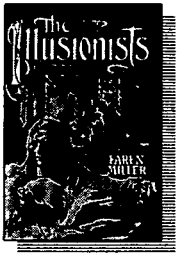

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rest of the people there start chattering among themselves. Even then, their voices were low, subdued.

Jennifer went back to her office to see how the campus computers were doing on a couple of her pet research projects. The new printouts had some important data, but didn't interest her as much as they should have: with three Foitani—Foitani!—enrolled in her course, she had trouble getting excited about revised charts of de Camp's use of the colon rather than the comma to introduce quotations, or on a fresh stemma tracing the spread of the word "thutter" from Anderson to writers of the next generation like Stirling and Iverson.

After lunch, she taught one course in modern Spanglish literature and another in composition, neither of which excited her very much but both of which helped pay her half of the rent for the apartment she shared with Ali Bakhtiar. She told herself she would have gone through them without much thought no matter what; with three Foitani in her morning class to think about, she knew she wasn't giving the afternoon sessions her full attention.

When she got back to the apartment, Bakhtiar was already there. His last class—he taught imaging, both tape and film—got out half an hour before hers. All she wanted to do was exclaim about the Foitani. He listened, bemused, for several minutes; she was not usually the sort to gush. At last, he held up a hand. "Wait one second, please. Why are you so excited about having these three aliens in your class?"

"That's what I was telling you," Jennifer said. "They're Foitani."

"So I'd gathered," he answered with a wry quirk of that eyebrow. (Sometimes she thought he practiced in front a mirror, but she'd never caught him at it.) "But who are the Foitani?"

She stared at him. "You really don't know?"

"Why should I?" he asked reasonably. "How many species of aliens do we know? Several hundred without hyperdrive, several dozen with it. That's on top of Allah only knows how many human-settled worlds. So why should I remember anything in particular about this one bunch?"

Jennifer knew he was right—humanity had spread too widely, learned too many things, for any one person to keep track of more than a tiny fraction of all there was to know. But somehow Bakhtiar's complete ignorance of the Foitani badly irked her. She wanted to exclaim over them and have him exclaim right back. How could he do that if he had no idea why she was exclaiming in the first place?

He saw something was wrong; after all, he had lived with her for a year. Spreading his hands to placate her, he said, "Tell me about them, then, if they're that important."

"Well, for one thing, we've only known they weren't extinct for about the past fifty years," Jennifer said. "They used to rule a big empire toward the galactic center, a good many thousand years ago. Then they started fighting among themselves; I don't think anybody knows why. They kept right on doing it, too, till they'd wrecked just about all the worlds they lived on."

"Wait a minute." A light came on in Bakhtiar's eyes. "Didn't they run a holovid special on that three or four

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years ago? Secret of the lost race, or something like that? I remember watching it, but I'd forgotten the name of the race."

"I suppose they may have," Jennifer said. Three or four years ago, she'd been dickering with chimpanzeelike Atheters over the price of *omphoth* ivory. "But yes, those were the Foitani. *Are* the Foitani," she corrected herself.

"Why have they enrolled in your Middle English class? What do they think they're going to get out of it?"

"I haven't the slightest idea," Jennifer said. "Of course, I don't know what about a third of my human students are going to get out of the class either, except for four units of credit."

Several years of trading missions among the stars had let her forget the time-serving students, the ones who took a course because they needed to fill a breadth requirement or because it happened to fit their schedules. The ones she'd remembered were the ones like herself, who enrolled in classes to learn something and worked hard at everything, for pride's sake if for no other reason. Saugus Central University had plenty of those. Unfortunately, it had plenty of the other sort too, as she'd found to her dismay.

Ali Bakhtiar said, "Well, it's nice you had something out of the ordinary to liven up your day. Let's go have dinner, shall we?"

"Foitani in a Middle English class is more than something out of the ordinary," Jennifer said. But Bakhtiar was already walking into the kitchen and didn't hear her—the apartment wasn't miked. Glaring at his back, Jennifer followed him.

She wanted to talk more about the aliens after dinner, but he turned on a battleball game and was lost to the world for the next couple of hours. Battleball required the biggest, strongest bruisers humanity produced. The Foitani, Jennifer suspected, could have torn most of them in half without working up a sweat (assuming Foitani sweated in the first place).

She didn't care about battleball one way or the other. She sometimes watched because Ali liked it so much—it gave them something to do together out of bed. Tonight she didn't fell like making the effort. She went into the bedroom to work on the computer for a while.

When she found herself yawning, she shut down the machine. She needed a few seconds to return from the distant past's exciting imagined future to her own thoroughly mundane present. Somehow hardly anyone in Middle English science fiction ever got bored or had to go to the bathroom at an inconvenient time or worried about her credit balance.

As *she* went off to the bathroom, Jennifer reflected that her own credit balance was in pretty good shape. Thanks to the *omphoth* ivory, she had a good deal more to her name than if she'd landed the first academic job she'd tried for. And she had no business being bored, not with three Foitani to wonder about.

She hoped the Foitani would get around to explaining just what they were doing in a Middle English course. She didn't know enough about their customs to risk asking straight out, but she'd die of curiosity if they kept quiet all semester.

She spat toothpaste foam into the

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sink. In the front room, Ali Bakhtiar yelled, "Reload and spin, fool, before he gets you!" The battleball game was in the last five minutes, then. Jennifer made a sour face. If Ali thought battleball more interesting than the Foitani, that was his problem.

Even when she got into bed, the big blue aliens would not leave her mind. Thegun Thegun Nug, Aissur Aissur Rus, and—what was the third one's name? Dargnil Dargnil Lin, that was it. She wondered if they were males or females. She thought of them as males, but that was only because they were large and had deep voices: anthropocentric thinking, the worst mistake a trader could make.

But she wasn't a trader any more. She was doing what she'd trained to do—what she'd always wanted to do, she told herself firmly.

Ali Bakhtiar came to bed a few minutes later. Her back was to him. She breathed deeply and steadily. He stroked her hair, slid his hand down to the curve of her hip. Most of the time, she enjoyed making love with him. Tonight, though, she was still annoyed at him for not caring more about the Foitani. She kept on pretending to be asleep. If Bakhtiar tightened that hand so she'd have to notice it, he'd get all the fight he wanted and then some.

He didn't. He took it away, muttered something grumpy under his breath that she didn't quite catch (*just as well, too,* she thought), and rolled onto his stomach. Moments later, he was snoring. As if to punish herself for feigning sleep, Jennifer lay awake for the next hour and a half.

* * *

The Foitani pulled their weight in the Middle English class. However they did it, they stayed up with the reading. They were certainly more familiar with human customs than Jennifer was with theirs; they asked good, sensible questions and seldom needed anything explained more than once.

Little by little, they started becoming individuals to Jennifer. Thegun Thegun Nug seemed to be senior to the other two; they deferred to him and let him speak first. Aissur Aissur Rus thought for himself. His interpretations of what he'd read were most apt to be off-base, but also most apt to be interesting and original. Dargnil Dargnil Lin, by contrast, was conservative: steady, sound, not likely to go far from the beaten path but perfectly reliable on it. The studies all three of them turned in were among the better ones she got from the class. No doubt they'd linked their translator programs with the printer, but humans whose first language wasn't Spanglish did that too.

Jennifer spent the first couple of weeks in the course on stories that dealt with alien contact. Experience had taught her that students enjoyed the theme, enjoyed seeing how wildly wrong most ancient speculation was. That some writers came within shouting distance of what the future really looked like also piqued their interest.

"Remember, science fiction wasn't supposed to be prophesy," she said. "Trying to foretell—to guess—the future is a much older set of thought processes. Science fiction was different. Science fiction was a literature of extrapolation, of taking something—some social trend, some new technology,

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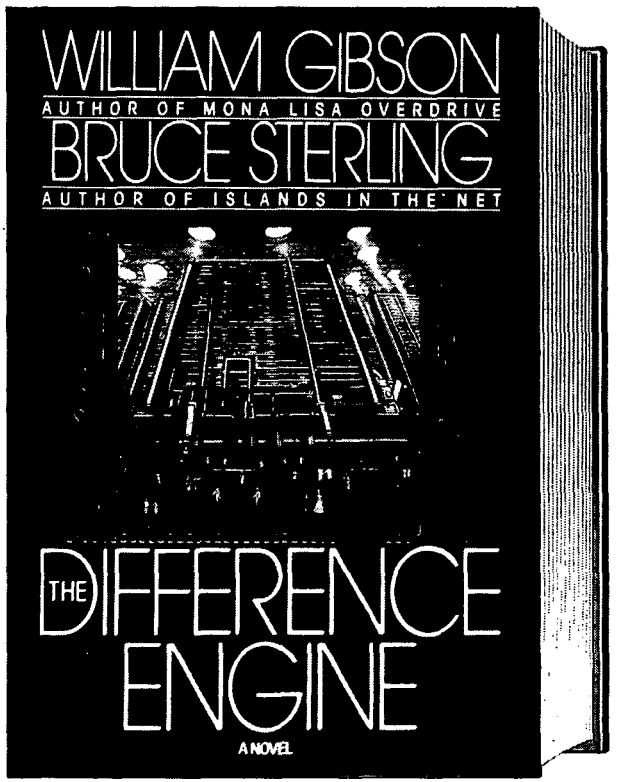

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even some ideology—that existed in the writer's time and pushing it farther and harder then it had yet gone, to see what the world would look like then.

"Of course, a lot of it became trivial even within a few years after it was written. Social trends, especially, changed so fast that they rarely lasted long enough to be carried to the extremes writers imagined. As humans have always been, in the twentieth century they were sometimes radical, sometimes reactionary, sometimes sexually permissive, sometimes repressive. They'd go through two or three of these cycles in a person's lifetime, as we do today.

"Some writers, though, chose harder questions to ask: how humanity would fit into a community of intelligent beings, some quite different from us; how we should treat each other under changed circumstances; what the relationship between government and individual should be. That's why writers like Anderson, Brin, and Heinlein can still make us think today, even though the worlds they imagined didn't come true."

Somebody stuck up a hand. "Why are the videos from that time at an intellectual level so much lower than the books?"

"That's a good question," Jennifer said approvingly. "The answer has to do with the economics of book and video distribution back then. Books made money with much smaller audiences than videos did, so they could target small segments—in the case of science fiction, generally the better-educated section—of the population, and present sophisticated ideas to them. Videos needed mass appeal. They borrowed the exotic settings and adventure of written science fiction, but seldom attempted to deal with serious issues."

"Another question, please, honored professor?"

"Yes, go ahead, Aissur Aissur Rus." Jennifer was always curious to hear what any of the Foitani would ask, and Aissur Aissur Rus had a special knack for coming up with interesting questions.

He did not disappoint her now: "Honored professor, I taste the intellectual quality of the authors you mention, which is indeed praiseworthy. Yet others—Sturgeon, Le Guin—seem to write more pleasingly. Which carries the greater weight?" His bearlike ears twitched. Jennifer thought that meant he was pleased with himself.

"Before I answer, Aissur Aissur Rus, may I ask a question in return?" Jennifer said. He waved a hand back and forth in front of his face. She knew that meant yes. She went on, "How have you learned Middle English well enough to have a feel for its style?" Not many human undergrads, even with computer aids, developed that kind of sensitivity to a language not their own.

Aissur Aissur Rus said, "To prepare us for this class, honored professor, our people used a Middle English/Spanglish program, a Spanglish/Raptic program —Rapti, you should know, is a world that once lay at the edge of Foitani space—and finally one from Raptic into our own tongue. Eventually our machines acquired sufficient vocabulary and context cues to abandon the two intermediate programs; they began to read directly from Middle English into our speech. From that point, it was not

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hard for us to learn Middle English directly."

"I . . . see," Jennifer said slowly. And indeed she did see how, but not why. What good was ancient science fiction to the Foitani? She almost asked straight out. Before she did, though, she felt she had to deal with Aissur Aissur Rus's question: "In their own time, the writers you named—and some others like them—were often very highly esteemed indeed, exactly because they were such fine stylists. And to say they did not address serious issues is not true, either. But they are less often read now because their concerns are not as relevant to us today as those of other authors. Do you see?"

"Yes, I taste the distinction you are cooking, but I am not sure it is valid," Aissur Aissur Rus said. "Again I ask, which carries the greater weight, abstract artistic excellence or utility?"

"That is a question humans have asked for as long as they have examined their own art," Jennifer said with a smile. "No one has ever come up with a definitive answer."

"Questions have answers," Dargnil Dargnil Lin said reprovingly.

"That may be so, but often only on a case-by-case basis—and with something as subjective as artistic elegance, one man's answer is another man's error," Jennifer said.

"Before the Suicide Wars, the Great Ones would have known." Even through the translator's flat tones, Dargnil Dargnil Lin sounded sure of that.

"If the Great Ones were as great as that, why did they fight the Suicide Wars?" Aissur Aissur Rus asked. Jennifer did not think the remark had been meant for the class to hear, but the translator sent it forth all the same.

Thegun Thegun Nug said, "Enough. We interrupt the discourse of the honored professor." All three Foitani visibly composed themselves to listen. Jennifer found she had no choice but to go on with her lecture. *One day*, she told herself, *I will ask my questions of them*. It would not be today, though.

"It's so frustrating," she said to Ali Bakhtiar when she got home from her last class. "They're good in class—they're very good. But *what are they doing there?*"

"I haven't the faintest idea," Bakhtiar answered, as he had every time she raised the issue. Now his patience showed signs of wearing thin: "I wouldn't lose sleep over it, either. If they want to spend good money to hear you talk about your musty old books, that's their problem, not yours."

"Musty old books? Problem?" Jennifer didn't know where to start being indignant at all that.

"You look silly standing there with your mouth hanging open," Bakhtiar said.

If she'd had her stunner on her belt, she would have given him a dose big enough to keep him out the rest of the night—and maybe for the week after that. Her mouth *was* open, she realized. She shut it. She wasn't indignant anymore; she was furious. Usually anger made her come to pieces. Now she knew what she had to do. When she spoke again, her voice was even tinier than usual: "I'll start looking for my own apartment."

Ali Bakhtiar stared at her. "Don't do that!" he said in alarm. She watched his

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face, the way his eyes moved up and down her. The alarm wasn't for her, at least not the part of her that dwelt behind her eyes. It was concern that he wouldn't be able to sleep with her any more. As if to prove it, he reached out to take her in his arms.

She took one step back, then another. He followed. "You leave me be," she said. She hated her voice for quavering. Her eyes filled with angry tears. She hated them even more.

"You're just upset," Bakhtiar said smoothly. "If it'll make you feel better, I'll apologize. Come here, Jennifer; it's all right." He put his hands on her shoulders.

A moment later he reeled away, right hand clutching left wrist. Jennifer hoped she hadn't broken it. She'd never needed unarmed combat on any of the worlds she'd visited, but all traders learned it, to protect themselves from aliens and humans both. Now she was using it for the first time, not a five-minute walk from the peaceful campus where she'd wanted to spend her days in quiet research. She'd already learned life didn't always work out the way one thought it would.

She walked past Ali Bakhtiar to the phone. He flinched back from her as if she'd suddenly sprouted fangs and talons; his eyes said he'd never seen her before. Maybe he hadn't, not really—maybe all he'd paid attention to was the small, shapely body, the blond hair that fell to the small of her back, the blue eyes and clear features. She started getting angry all over again.

She keyed the number of a friend, a colleague in the dead languages department a few years older than she. "Ella? It's Jennifer. Is there any chance I could sleep on your couch for a few days? I've had a fight with my boyfriend, and I'll be moving out of here as soon as I can."

"I don't see any reason why not," Ella Metchnikova answered, her almost baritone contralto booming in Jennifer's ear. "Come on over."

"Thank you, Ella dear. I will." Jennifer hung up, threw some books, disks, and papers into an attache case, then tossed the case, a change of clothes, and her toothbrush into a blue plastic shopping bag. She paused at the door to look back at Ali Bakhtiar. "I'll be out of here just as quick as I can get a place. If you mess with my things, even a little bit, I won't hit you in the wrist next time. I promise you that."

Then she had an afterthought. She went past Bakhtiar again, this time into the bedroom. It spoiled her grand exit, but she did not care for melodrama in her own life anyhow. She found her stunner, dropped it into the bag too. One more trip by her lover—her former lover, she amended to herself—and she was gone.

Ella Metchnikova lived only a few blocks away. Her apartment building—and her apartment—were near clones of the one in which Jennifer had lived; the same construction company must have put up both of them.

Ella was large and blustery. She hugged Jennifer when she came in, kissed her on each cheek. "You have my sympathy, if you want it," she said. "More likely you think you're well rid of him, and if you think that, you're probably right. Let me give you something more practical instead." She took

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a glass from the refrigerator and handed it to Jennifer.

Jennifer sipped cautiously. Ella had handed her glasses before. Sometimes they were tasty, sometimes anything but—one of Ella's hobbies was reconstructing drinks nobody had drunk for hundreds of years. There were often good reasons why nobody had drunk them for hundreds of years.

This one wasn't bad—smooth, a little sweet, not alcoholic enough to scorch her throat or make her eyes water. As she was supposed to, she asked, "What's it called?"

"A Harvey Wallbanger," Ella said: "orange juice, ethanol, and a liqueur called Galliano that I just found a bottle of last week. I thought it was long since extinct, but somebody still makes it. Can't imagine why. It's death by itself—think of high-proof sugar syrup with yellow food coloring. But it is good for something, you see."

"Yes, so it is." Jennifer took a larger sip, then another one. Warmth spread from her stomach. "Thanks for taking me in on short notice."

"On no notice, you mean." Ella laughed. A moment later, the laugh got louder. "I didn't know anybody on this planet could blush."

Jennifer's cheeks only grew hotter. "I can't help it if I'm fair."

"I know you can't. I can't help laughing about it, either. Have you had dinner?"

Jennifer let Ella mother her. It took her mind off the sudden crash of her relationship with Bakhtiar and off the hideous nuisance of moving—although her trader training would come in handy there, for she was used to packing quickly and thoroughly. Her trader training kept coming in handy all sorts of ways, something she'd certainly not expected when she signed up as an apprentice. All she'd wanted was something out of the ordinary on her resumé.

After dinner, she accessed the realty datanet to see what sort of apartment she could find. The results of the search annoyed her: since the semester had begun, the units nearest the campus were filled up. "Nothing closer than three kilometers," she complained.

"Maybe I ought to take that one," Ella said, looking over her shoulder. "You could have this place. I need the exercise more than you do." She sighed. "No, it wouldn't do. Knowing me, I'd take the shuttle in instead of walking. Oh, well."

Still grumbling, Jennifer electronically arranged to move into the nearest apartment she'd found, though she put in a withdrawal option in case something closer to the university opened up before she took possession of the new place. She'd enjoyed walking to work. She could afford the penalty she'd have to pay if she used the option.

"When does it become vacant, three days from now?" Ella asked.

"That's right. I hope I won't be too much of a bother till then," Jennifer said. She'd already started thinking about what she could give Ella to repay her kindness.

"Tonight's not a problem, and neither is tomorrow. But the day, or rather the night after that—well, I'd invited Xavier over, and . . . you know what I mean," Ella said.

"Oh, yes," Jennifer said quickly. Ella and Xavier had been lovers for a

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long time. Jennifer didn't know how long, but it was longer than she'd been on Saugus. "I'll find someplace else to be, even if I have to sleep in the office that one night. It has a couch, of sorts—it wouldn't be too bad, really. And I'll be going into the new place the next day, so I won't cramp you any more after that."

"You're sweet, Jennifer. Sometimes I think you're too sweet for your own good. That's why you surprised me when you said you were breaking up with Ali. What touched that off, if you don't mind my asking?"

Jennifer started to explain about the Foitani. Before she'd gone three sentences, she ran into the same wall of incomprehension with Ella that had driven her out of the arms of Ali Bakhtiar. Even though humans had spread over several thousand light-years, most of them, if they traveled at all, went from one human-settled planet to another, and had only sketchy dealings—if any—with the many other species who shared the galaxy with them. Ella knew a lot more about ancient distilling techniques than she did about the Foitani.

When Jennifer was done, her friend shrugged and said, "It doesn't seem like much of a reason to me, but you know you best. And it sounds like something else would have happened if this hadn't."

"I suppose so," Jennifer said. "I guess I knew I was more or less marking time with Ali." She ruefully shook her head. "I hadn't expected to get my nose rubbed in this way, though."

"You never do," Ella said. "I remember this fellow I was seeing about ten years ago—" The tale that followed went on for some time, and was more lurid than the fiction Jennifer was used to reading.

When she tried to sleep in Ella's front room, Jennifer tossed and turned. She was still upset. Moreover, the couch was harder and narrower than her big bed. The room wasn't as dark as her bedroom, and the noises of ground traffic outside were louder. Someone in an apartment across the courtyard had a clock that chimed the hours. She listened to it announce midnight, then, a year or so later, one o'clock. Finally, she slept.

Ella's alarm screamed like a banshee—worse than an Atheter, Jennifer thought fuzzily as her panic at the hideous noise faded and she realized what it was. Ella was either a serious sleeper or selectively deaf, because the clock squalled on and on until at last she yelled for it to shut up.

Jennifer winced at her red-tracked eyes after she got out of the shower. She felt as if she had a hangover, without even the remembered pleasure of getting drunk the night before. Moving as if underwater, she dressed in her one clean outfit (she made a mental note to wash the shirt and skirt she'd worn yesterday), dove into a cup of coffee, gulped down a fruit bar, and headed for the university.

The caffeine and the thought of the material she was going to present made her more lively by the time her Middle English class rolled around. She was beginning a new unit today, which also pleased her; she felt as if she was turning over a whole new leaf in her life. That absurd jingle left her chuckling to herself as she strode into the lecture hall.

The chuckles disappeared before she

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reached the podium. She fixed the class with as steely a gaze as she could muster—not very steely, she knew down deep, but she did her best. In what she hoped was a stern voice, she demanded, "Who hasn't kept up with the reading for today?"

A few luckless souls, lazy and honest at the same time, raised their hands. "You'll have to do better than that," she told them. "You knew when you enrolled—you certainly knew when you saw the syllabus—your work load would be heavy here. You have to stay with the lectures if you expect to get full benefit from the course."

Thegun Thegun Nug and the other two Foitani had kept their big, thick-fingered hands down. Jennifer was sure it wasn't because they didn't want to admit they'd fallen behind. She almost used them as an example, to say to the rest of the class, *See, if they can keep up, you ought to be able to.* Only the thought that they might not want to be singled out held her back.

She said, "We're not going to look at imaginary aliens for a while. Instead, we'll consider science fiction's examination of a problem that was pressing for several generations: the risk that mankind would annihilate itself over local disputes on Earth before it acquired the technology to get off the planet."

All three Foitani sat straighter in their slightly too small chairs. She thought of the history of their race and shivered a little: a species didn't have to be planetbound to do a pretty fair job of annihilating itself.

"For those of you who did read the lesson," she went on, "we'll discuss *A Canticle for Leibowitz* first. Ever since it was written, many people have named it the best science fiction novel of all time. The section I want to examine now is the middle one, the one called '*Fiat Lux.*' "

"What is the meaning of this heading?" Aissur Aissur Rus asked. "Our translator program broke down on it, making obscure references to ancient wheeled conveyances and soaps. This does not seem appropriate to the content of the book."

"It sure doesn't." Jennifer wondered how any program could come up with anything so farfetched. "Maybe the problem is that the heading isn't in Middle English but rather Latin, a still older human speech. '*Fiat Lux*' means 'let there be light.' "

"Ah." That wasn't Aissur Aissur Rus; it was a human student. Several others also made notes. Jennifer silently sighed. *Lazy,* she thought. They should have had no trouble accessing the meaning of the phrase. Not only was Latin still used liturgically, it was an important ancestral tongue to Spanglish.

" '*Fiat Lux*' is particularly interesting for its blend of historical analogy and extrapolation," she said. "The role of the church in the piece is based on what the church actually did after the collapse of the Roman civilization earlier in Earth's history (the Romans, by the way, were the people who used Latin).

"But the civilization which Miller envisioned collapsing after nuclear war was his own, which had already become highly dependent on technology. As civilization restored itself, as it began to discover once more how the world

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worked, it also began to discover that it was in fact rediscovering, was only finding out what its ancestors had already known. Miller effectively paints into his book the intellectual turmoil this realization would create—''

Jennifer stopped there. She hadn't intended to, but one glance at the Foitani would have distracted anybody. They weren't making a racket, they weren't even jumping up and down, but they had come to full alertness for the first time in her presence. When a large creature—three large creatures—with spiky ears and good teeth becomes fully alert in a human's presence, the human becomes alert too. Three million years of biological programming was screaming in her ears: *Wolves!*

She needed only a moment to collect herself. Thanks to her time as a trader, she knew how to break free from the prejudice of shape. (She was thanking her time as a trader rather often these days. That annoyed her, all the more so as she'd wished she was on a nice, quiet university campus while it was going on.)

She said, ''Is there a question?'' Her voice was still light, but steady enough.

She'd expected the Foitani to be bursting with questions. They surprised her. They started when she spoke to them, then looked at each other, as if she'd caught them picking their noses (if doing that was bad Foitani manners).

Finally Thegun Thegun Nug said, ''No, no questions at this time, honored professor. We were merely interested in the analogies between the world this author draws and the experiences of our own people.''

''Very well. I'll go on,'' Jennifer said. The translator's tone was as bland as ever, but she knew she'd heard a lie just the same—or at least, not all of the truth. Something more than interest in analogies had stirred up the Foitani there. But if they didn't care to talk about it with a human, what could she do?

Distractedly, she got through the rest of the day's presentation. The discussion was less lively than she'd hoped, not least because the Foitani had stopped taking part. They paid close attention to everything she and the human students said, though: their ears kept twitching. Maybe that was a reaction they couldn't control.

When Jennifer got back to Ella's apartment, she wanted to talk about the aliens' extraordinary reaction to *A Canticle for Leibowitz*. Ella didn't want to listen. Ella was planning tomorrow's extravaganza with Xavier, and wanted to talk about that. Jennifer, who was sick of men in general and Ali Bakhtiar in particular, made a poor audience.

After she and her friend discovered they weren't going to communicate that evening no matter how hard they tried, Jennifer began playing with the computer and de Camp's colons again. She wondered if some of the works where commas appeared instead were the work of overzealous copy editors. Offhand, she couldn't think of a single twentieth-century author who had a good word to say for copy editors.

The next day in class, she talked more about *A Canticle for Leibowitz*, and compared it to other works that looked at the aftermath of atomic war: *Davy*, *The Postman*, *Star Man's Son*. ''This sub-genre of science fiction was played

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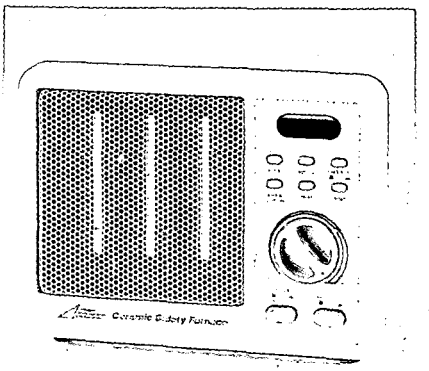

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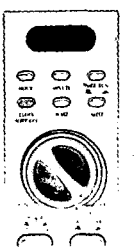

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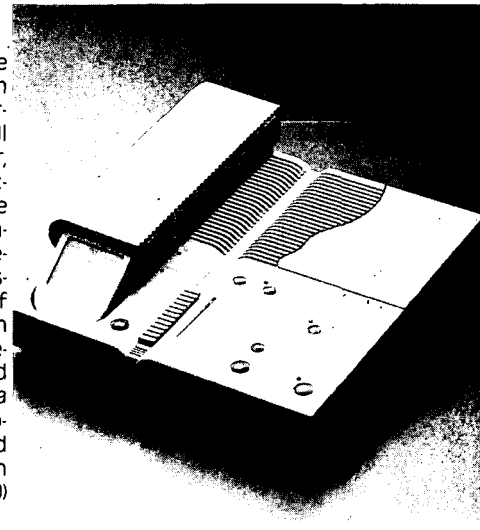

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out by the end of the twentieth century," she said. "By then it had become plain that such a conflict would not leave the survivors, if there were survivors, in any condition to recover as quickly as earlier writers had imagined."

Again, the Foitani stirred. Again, Jennifer thought they would say what was on their minds. Again, they did not. She felt like kicking them. Unfortunately, that seemed to lie in the unpleasant middle ground between foolhardy and suicidal. The Foitani had been willing, even eager to talk before. Why not now, with a topic that really hit them where they lived? Jennifer had no answers. Grumbling to herself, she finished her presentation and stalked out of the lecture hall.

She went through her other two classes on automatic pilot. Still on automatic pilot, she started back toward her own apartment. After a couple of hundred meters, she muttered, "Idiot!" under her breath and turned toward Ella's building. After another fifty meters, she said, "Idiot!" again, much louder this time. A student close enough to hear gave her a curious look. Her cheeks flamed. That seemed only to interest the student more—he was a young man. Jennifer spun away from him, and tramped with a grimly determined stride back to her office.

It wasn't the ideal place to spend a night. The "couch of sorts" was considerably more disreputable—and shorter—than the one in Ella's apartment. But the rest room was only a couple of doors down the hall. For one night, it would do. *Tomorrow*, Jennifer thought, *I'll be in my own new apartment*. That made the idea of one uncomfortable evening—even the thought of a dinner at the university cafeteria—bearable.

The dinner turned out bearable, too. Jennifer's best guess was that the university food service would soon fire whoever was responsible for cooking something edible. She took her Coke (what else, she said to herself, would a professor of Middle English drink?) out into the evening twilight and walked across campus slurping on it.

Once back in her office, she dutifully set to work. No one yet had come up with a computer program for grading essays. She scribbled marginal comments in red ink. At least Spanglish orthography corresponded to sound; she didn't have to deal with the erratic spelling that had plagued Ancient and Middle English.

Twilight faded to darkness around her. At just after 2100, a security guard phoned. "Sorry, Professor Logan," he said when he saw her face. "Just checking—the IR telltale showed somebody was in there. As long as it's you, there's no problem."

"I'm so glad," she said, but he had already switched off.

She tried to recover her train of thought. This student actually showed some grasp of how Piper had put together his future history, and she wanted to make sure she cleared up the gaps in the girl's understanding.

Just when she had reimmersed herself in the essay, the phone chimed again. This time, it was Ali Bakhtiar. "What do you want?" Jennifer said coldly.

Bakhtiar flushed. "I want to apologize again," he said. "I've just met

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your Foitani, and they're at least as impressive as you said they were. At least." He looked more than a little shaken. He didn't look shaken very often.

"Wait a minute. You *met* them? How did you meet them?"

"They came over here looking for you. They said they wanted to talk with you about the class. They didn't seem much interested in taking no for an answer, if you know what I mean. Finally I convinced them you'd moved out. I sent them on to your friend with the deep voice—Ellen Metchnikova, is that right?"

"Ella," Jennifer corrected absently. "Oh, God. She's not going to be very happy to see them. She has company tonight."

"I gathered that," Bakhtiar said. "I called her place to warn you they were coming, and she didn't much want to talk. She kept the vision blank, too. She snapped out where you were and switched off. So now you know."

"Oh, God," Jennifer said again. Ella would be a long time forgiving her for this, if she ever did. "Thanks, Ali, I guess. Better to know they're on the way."

"Listen, is there any way you could forget about moving out and come back here?" Bakhtiar said. "I really am sorry about what I said before, and I—"

"No, Ali," Jennifer said firmly. She'd already done all the thinking she needed to do about that one. "I'm sorry too, but I don't think we were going anywhere anyhow. Just as well to break it off now. I hope we can still be friends, but that's it."

Bakhtiar scowled. "I hate when women say that. Anyway, though, I thought you ought to know about these creatures of yours. Good luck with them."

"They're not my creatures," Jennifer said, but Bakhtiar, like the security guard, didn't wait on the line to give her the last word. Shaking her head, she stared down at the essay on Piper. "Where was I?"

Just when she thought she remembered, the phone chimed again. She muttered something under her breath and jabbed a thumb at the ACCEPT button. The vision screen did not light. *Ella*, she thought, and Ella it was. "Jennifer, three blue behemoths are on their way to visit you."

"Thanks Ella, Ali just phoned to warn me he'd sent them to your place. I'm sorry about that," Jennifer added.

"You ought to be," Ella snapped. "I don't like being interrupted when I'm right on the edge, and I especially don't like being interrupted twice."

"Oh, dear." Jennifer swallowed a giggle.

"If you weren't my friend— Well, these Foi-whatevers look big enough to have you for breakfast instead of talking, if that's what they want. Maybe you should keep your door locked after all."

"Don't be silly, Ella. Go back to Xavier, and I hope nobody interrupts you any more."

"Better not," Ella said darkly. "Goodbye." As it was the first one she'd got in three calls, Jennifer cherished that goodbye. She went back to work on the essay, hoping to finish grading it before the Foitani arrived.

A few minutes later, the elevator

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down the hall beeped. *The Foitani,* Jennifer thought. She put aside the paper; maybe it was never going to get finished. As it went back onto the pile, her brows came together. To get into the building this late, you were supposed to have an authorization card for the elevator to read. Then she shrugged. Maybe the Foitani had ridden up with someone who had a card. They knew her name, after all; a little explaining would be all they'd need.

Someone knocked on the door—knocked so high up on the door that it could only have been a battleball centerliner or a Foitan. She hadn't heard footsteps in the hall, but then the Foitani didn't wear shoes. They were very smooth and quiet for beings so large, as if they were closer to hunting ancestors than humans were.

Jennifer opened the door, looked up and up. Thegun Thegun Nug towered over her; behind him stood the other two Foitani. Close up, they really were intimidating. Without intending to, she took half a step back before she said, "Hello. What can I do for you this evening?"

"You can come with us," Thegun Thegun Nug said.

The flat tone of his translator made Jennifer unsure just how he meant that. "I'd sooner talk here," she answered.

"It was not a conditional request," Thegun Thegun Nug said. Only then did she notice he held something in his left hand; anthropocentrism made her automatically look toward the right first.

The something sparked. That was all Jennifer remembered for a long time.

* * *

When she woke up, she was on a starship. The realization filtered in little by little, with her returning consciousness. Perhaps it took longer than it should have, for she had a headache like a thousand years of hangovers boiled down into a liter. Her trading stunner would quietly put a person out for an hour or two and leave her feeling fine when she woke up. Whatever the Foitani used didn't work that way. Oh my, no. The first time she tried to sit up, her head felt as though it wanted to fall off. She rather wished it would, so she could forget it for a while.

After a bit, she began to notice things other than her pounding skull. The gravity was a good deal higher than Saugus's comfortable .85. It wasn't a planet's geefield, either. She didn't know how she knew the difference—no star traveler had ever succeeded in putting it into words—but she knew. The air was more than conditioned; it had the perfect flatness a good recycling plant gives.

Everything pointed to its being a Foitani ship, too. The chamber that held her was bigger and had a higher ceiling than humans were likely to build. Even the plain foam pad on which she lay was outsized. The light from the ceiling panel had an oranger cast than humans would have used.

She looked around; she had to close her eyes several times at the pain turning her head cost her. But for the bare mattress, the only things in the chamber with her were three plastic trash bags. She crawled over to them, moving slowly and carefully because of both the higher gravity and her headache. The trash bags held everything she'd had at her office, from her toothbrush to her

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computer to the complete contents of her desk, right down to paper clips and small change.

With a gasp of delight, she found her stunner. The delight quickly disappeared. Given that she was on a Foitani ship, which she had no idea how to fly, how much good was the stunner likely to do her? She would have traded it in an instant for a year's supply of tampons. Since no one appeared with the trade offer, she clipped the stunner onto her belt.

Then she looked around for a place to relieve herself. Somehow, no one in her Middle English novels ever worried much about that. Neither had she, until she went on her first trading run. Squatting in the bushes brought her down to basic reality in a hurry.

She picked the corner farthest away from the foam rubber mat. If the Foitani didn't come in and give her somewhere better to go before she had to empty her bladder, they could clean up after her themselves.

She was uncomfortable but not yet desperate when a door appeared in the far wall of her chamber: one second it wasn't there, the next second it was. Thegun Thegun Nug stepped inside. Of itself, her hand reached for her stunner. "That will do you no good," the Foitan said.

Suddenly she wasn't so sure. Maybe she couldn't fly this ship herself, but if she knocked Thegun Thegun Nug out and threatened to start carving him into strips a centimeter wide, his henchbeings might be persuaded to turn around and take her back to Saugus. She pressed the trigger button.

Thegun Thegun Nug bared his teeth, but uncooperatively refused to fall over in a large blue heap. "I said that would do you no good," he told her. "Your weapon makes me itch, but it does not make me sleep. Foitani stunners use a different ray."

Jennifer's gonging head gave anguished testimony to the truth of that. Back to her next priority, then: "Take me to whatever you people use for a toilet."

Thegun Thegun Nug took her. He even walked out of the room and left her alone. "My folk do not require privacy for this function, but we have learned humans prefer it." The door in the wall did not disappear, though.

"Thank you so much," Jennifer said, acid in her voice. "Why couldn't you have left me with my privacy back on Saugus, instead of kidnapping me?"

Her sarcasm rolled off Thegun Thegun Nug's blue skin. Through the opening in the wall, he answered, "You are welcome. And you would not have come with us of your own free will from the world you call Saugus; you were content there. But we have need of you, have need of your knowledge. Thus we took you."

"Thanks a lot," Jennifer muttered. The sanitary arrangements were simple enough: a couple of round holes in the floor, each close to half a meter wide. She squatted over one of them. When she was done, she called to Thegun Thegun Nug, "Do you have anything I can use to wipe myself clean? Something soft and absorbent, I hope."

"I will see," the Foitan answered after a moment. "My species' orifices do not have this difficulty." Now the doorway vanished. The Foitan stayed

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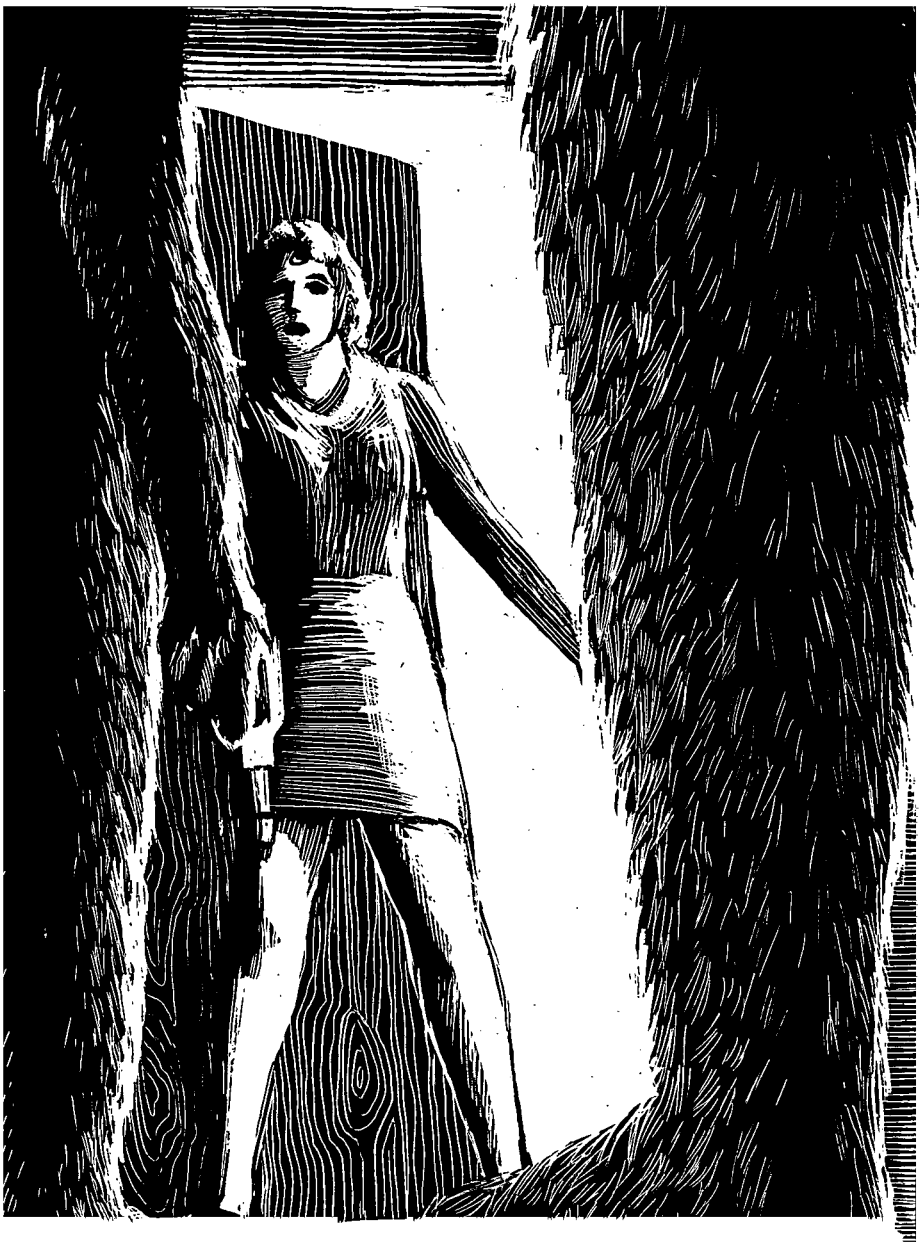

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away for a quarter of an hour. When he returned, he brought a length of gauzy cloth. "This is from our first aid kit. Use it sparingly. It is all we can afford to give you."

"How long will the flight be?" she asked. Thegun Thegun Nug did not answer. She tried another string of questions: "What do you mean you have need of my knowledge? How do you know what I know? And what good is the knowledge of a professor of Middle English to you, anyhow?"

Thegun Thegun Nug chose to respond to one of those questions: "You were recommended to us by another human."

That only created more confusion for Jennifer. "I was? By whom?"

"By one with whom we have worked. He came across a situation beyond his expertise, and suggested you were the one to employ. From all we have seen of you, the probability that he is correct seems, if not high, then at least significant. He will also give you such aid as he may: he is still within Odern space."

"Odern?" The translator had left the word unchanged.

"Odern is my planet," Thegun Thegun Nug said. "It is one of the one hundred twenty-seven worlds within our former sphere that still support Foitani life, one of the nineteen where starflight has been rediscovered. Before the Suicide Wars," he added, "we had settled on several thousand worlds; the precise number is still a matter of dispute among our scholars."

Jennifer shivered. She tried to imagine how humanity would fare with 95 percent of its planets swept clean of life. She also wondered what the Foitani had found important enough to fight about on such an enormous scale. Humans had battled over religion with similar ferocity, but the rise of technology had weakened religion's hold on mankind. Maybe the Foitani had kept their fanaticism after they reached the stars.

Thegun Thegun Nug said, "Analysis of our rations has shown that you may safely eat them. You need have no concern on that score."

"How nice." Jennifer set hands on hips, took a deep breath. "You haven't given me a single reason why I should have the least bit of interest in doing anything for you. And I tell you this: kidnapping me like this has given me an awfully big reason not to."

"You have been on our payroll since the day we enrolled in your class, honored professor," Thegun Thegun Nug said. "We will pay standard journeyman merchant's wages, either in your currency or trade goods—your choice."

"I wasn't talking about money," Jennifer said. "And you have gall, too, putting me on your payroll for something I have less than no interest in doing."

For the first time outside the lecture hall she succeeded in impressing the Foitan. "Money is not a sufficient inducement?" he said slowly. "I had been given to understand—and nothing I observed on Saugus diminished my understanding—that humans are a mercenary species, willing even, at times, to take arms against their own race or kin-group for the sake of profit."

"Some humans are. This human isn't. Damn you"—Jennifer heard her voice breaking, but could not do anything about it— "I was doing what I wanted to do, at last, after years of not

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being able to. What right do you have to take me away from that?"

"The right of species self-interest," Thegun Thegun Nug said, "which to us is paramount. I might also point out that, at need, physical coercion is available to force you to our will."

Jennifer's stomach turned to a small, chilly lump of ice. She felt her knees wobble. She was sure, though, that the more weakness she revealed to this inexorable alien, the worse off she would be. She looked up into the Foitan's round, black eyes. "How well do you think I'd do for you if you tortured me into submitting?"

"Less well than if you cooperate voluntarily, I admit. Torture, certainly, would be a last resort. I am, however, perfectly prepared to take away from you all your possessions and leave you alone in your chamber until ennui induces you to evince a more constructive attitude. My race has been waiting for 28,000 years. A fraction of another matters little to us."

She had no doubt Thegun Thegun Nug meant exactly what he said. Being bored into cooperation was attractive only in comparison to being tortured. The worst of it was, the trader part of her wanted to go along with the Foitan. *No, the traitor part,* she thought. But how many merchants had won the chance to trade with the Foitani? If looked at the right way (*the wrong way*, the professorial part of her insisted), that was what she'd be doing—trading her knowledge (if she did know what the aliens thought she knew) for their goods. If she couldn't skin them on that deal, she didn't deserve to be a journeyman.

"All right," she said. "If you think I'm worth risking an interstellar war to get, I'll do what I can for you—provided you let me go after I'm done."

"Certainly," Thegun Thegun Nug said at once. "As for risking war with humans, I will only say it is highly unsafe for ships flown by other species to enter Foitani space unescorted. It is not altogether safe for our own ships to fly. Many weapons from the Suicide Wars are in free orbit throughout our former domain, and hard vacuum is an excellent preservative."

"Wonderful," Jennifer muttered. Now all she had to do was worry about hitting a mine that had been floating free since the days when Cro-Magnon man chased woolly mammoths between glaciers back on Earth.

"It is not wonderful, but it is a fact," Thegun Thegun Nug said; none of the three Foitani had much of a sense of humor. "Our detectors should suffice to get us back to Odern, however."

"They'd better," Jennifer said. "If we blow up, I'll never forgive you."

Thegun Thegun Nug started to answer, stopped, seemed to think better of it. At last he said, "Come. I will return you to your chamber."

"What happens the next time I need to relieve myself?"

"One of us will escort you here. Were our situations reversed, would you trust me unescorted on a human ship?"

Jennifer wanted to say she wouldn't trust the Foitan no matter what. That did not seem politic at the moment, regardless of how true it was. Without a word, she followed Thegun Thegun Nug out of the toilet chamber and back to her own. She thought hard about annoying her captors with toilet calls at every hour

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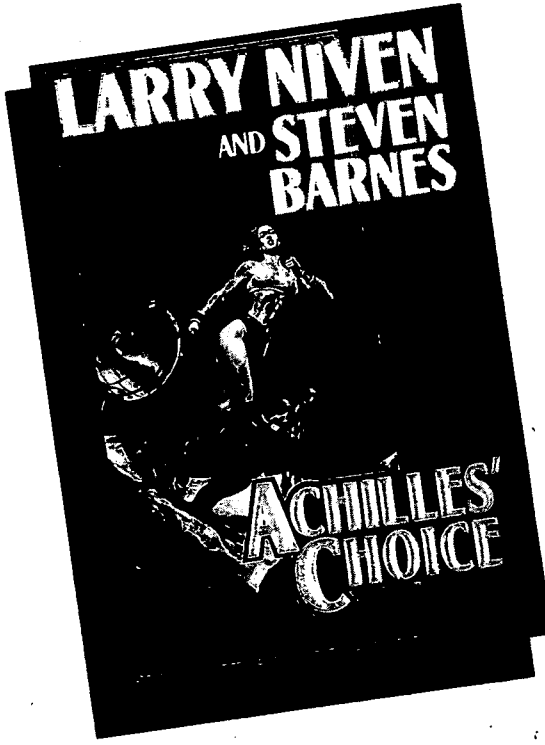

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of the day and night. With some species, she might have tried it. Her best guess, though, was that the Foitani would simply stop coming after a while, leaving her to foul her chamber. She decided not to risk it.

Aissur Aissur Rus brought her a plastic pouch of food a couple of hours later. She looked at it without enthusiasm. It resembled nothing so much as dry dog food. "This will nourish you, and should cause no allergic responses," the Foitan said.

Of the three aliens, Jennifer thought Aissur Aissur Rus the most open. Hoping he would answer where Thegun Thegun Nug had not, she asked, "Why did you people grab me? What do you think I can do for you, anyhow?"

"It was my idea, actually," he said.

She stared at him. After liking him the best, hearing that jolted her. "What is it you want from me?" she repeated.

"One of your human sages once said, 'I am a midget, standing on the shoulders of giants.' When we Foitani of the present days look at the deeds of the Great Ones before the Suicide Wars, we are midgets trying to see up to the shoulders of giants. Perhaps you can help us do that. If not, perhaps you can help us see around the giants' bodies to a new way."

Jennifer frowned. Thegun Thegun Nug had evaded her questions. Aissur Aissur Rus seemed to answer openly enough, but the answer did not mean anything to her. "Go away and let me eat," she told him.

"I did not know you required privacy for that," he said.

"I don't require it, but I'd be grateful. I have a whole lot of things I need to sort out in my mind right now. Please."

Aissur Aissur Rus studied her. The Foitan's eyes had no sclera, no iris, no pupil. They were completely black and completely unreadable. At last, without a word, he made the doorway appear in her wall, walked through it, and made it disappear after him.

She ate. The coarse, crunchy lumps in the plastic pouch tasted like what she thought dog food ought to taste like, too; they came from something that had been meat quite a while ago. She made herself go on eating till she was full.

When she was done, she looked up at the ceiling and said, "I would like something to drink, please." The Foitani had to have electronic eyes and ears in the chamber.

Sure enough, Aissur Aissur Rus brought her a jug a few minutes later. "This is pure water," he said. "You may drink it safely."

"Thank you," Jennifer said. "May I also have water for washing?"

"Perhaps when you go to the toilets, so it will run down into a disposal hole," Aissur Aissur Rus said. "How often do you usually wash? The human custom is once a day, is it not? I suppose that might be arranged."

"You might have thought beforehand about what I'd need," Jennifer said.

"We are not used to considering the needs of other species. It is not the Foitani way, and does not come easy to us."

"Really? I never would have noticed."

Irony bounced off Aissur Aissur Rus as if he were iron-plated. When he saw Jennifer had no more to say, he turned

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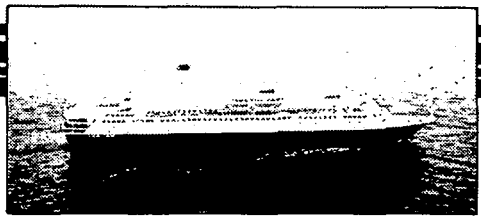

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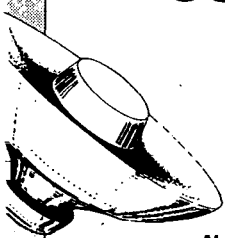

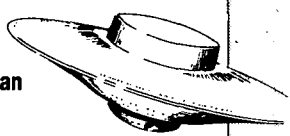

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and left as abruptly as he had before. She drank the jug dry. The water was cold, and had the faint, unpleasant taste of distilling. It did help to ease her headache.

The jug was made of soft plastic. She flung it against the wall nonetheless. It denied her the good satisfying crash she craved, falling to the ground with a dull thump. She walked over to it and kicked it as hard as she could. That helped, but not enough. She found a pen, drew a couple of black circles on the side of the jug to stand for Foitani eyes. She kicked it again.

"Better," she said.

Jennifer's computer insisted the flight to Odern lasted twenty-three days and some hours after the aliens snatched her away from Saugus. She thought it felt more like twenty-three years. By the time the ship landed, she wished all the Foitani had succeeded in blasting themselves to hell and gone—and then another twenty kilometers, for luck.

For one thing, her period arrived while she was in space, with no possibility of privacy whatever. She didn't much feel like explaining to the aliens how her plumbing worked, but she didn't have much choice, either, not if she wanted to keep her clothes clean. This time, they gave her all the absorbent cloth she wanted without arguing; menstruation, evidently, was one aspect of humanity about which they hadn't informed themselves.

"You wanted me, you got me—just the way I am," she told Thegun Thegun Nug.

"As you say." The Foitan hesitated. "You are certain you are not wounded?"

"I'm certain."

"As you say," Thegun Thegun Nug repeated. Though his translator sounded flat as ever, he did not seem convinced. *Squeamish, are you?* Jennifer wondered. She wished she could break out in green, smelly spots, just to revolt him.

For another, she got thoroughly sick of kibbles and water as a standard diet. "You knew you were going to kidnap me," she snarled at Dargnil Dargnil Lin. "Why didn't you buy—or even steal—something edible for me?"

"These rations are both edible and nutritious," Dargnil Dargnil Lin answered primly. "They are adapted for human needs from our standard spacecraft fare."

"You mean you eat this stuff all the time when you're in space?" Jennifer asked. When Dargnil Dargnil Lin waved a hand in front of his face in the Foitaini equivalent of a nod, she said, "That's the best argument against spaceflight I ever heard." Dargnil Dargnil Lin left quite suddenly. *Maybe*, Jennifer thought, *I've managed to annoy him for a change.* She hoped so.

The one good thing about the flight was that it met none of the infernal devices left over from the Suicide Wars. Having to go that far to find something good brought the rest of the journey into perfect perspective for Jennifer.

She did not even know the ship had touched down until all three Foitani appeared outside the disappearing doorway. "Come with us," Thegun Thegun Nug said.

"How can I say no?" Jennifer murmured. Not only did he have his two immense comrades to help enforce his

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wishes, he was also carrying that vicious Foitani stunner. Getting shot with it was better than dying, but only a little.

The Foitani led her in the direction away from the lavatory. That was her first hint something unusual had happened. Any hope she had of seeing more of the ship quickly went by the wayside; one stretch of blank corridor looked just like another. But the chamber they went into had big spacesuits in a rack to one side; in a human ship, that would have made it the airlock.

Thegun Thegun Nug touched a panel on the far wall. Another doorway opened. Sunlight poured in. So did fresh air. After more than three weeks of the recycled product, it smelled amazingly sweet. The doorway framed buildings and green hills. *The green hills of Odern*, Jennifer thought. She shook her head. Rhysling would not have approved.

Thegun Thegun Nug turned and went backwards out the door. Since he didn't fall, Jennifer figured he was going down a ladder. Aissur Aissur Rus followed him. "Now you," Dargnil Dargnil Lin said. "I will come last." Since he also had a stunner, Jennifer did not argue.

The way down proved not to be a ladder, but rather rungs set into the side of the spacecraft. The rungs were made for people the size of Foitani, so they were much too far apart for Jennifer. She was enough meters off the concrete below to get nervous at the thought of missing one, which did nothing to improve her grip.

"Hurry, can't you?" Dargnil Dargnil Lin called from the airlock.

"No, I can't," she said through clenched teeth. By the time she reached the ground, sweat was pouring from her armpits, too. She wanted to stand where she was and catch her breath, but from the way Dargnil Dargnil Lin was descending behind her, he didn't care whether he landed on her or not. She skipped aside in a hurry.

Once on the ground, Darngil Dargnil Lin reached up and slapped the side of the ship. The rungs vanished, leaving the side smooth once more. It had to be memory metal, Jennifer thought. On human worlds, the stuff was a toy. The Foitani looked to have exploited the technology more intensively.

As soon as the rungs disappeared, her captors seemed to forget all about her. They faced the low, rounded green hills behind the spaceport, and bowed themselves almost double. Still bowed, they began a slow, mumbling chant. Their translators picked up some of it for Jennifer: "Great Ones, look kindly on us. We return to Odern our homeworld faithful always to our mission to regain the glory you once knew. Though earthgrip holds you now, we shall redeem you. May your glory return speedily, Great Ones, speedily. So may it be."

"You worship the Foitani who lived before the Suicide Wars?" Jennifer asked when Thegun Thegun Nug and his companions decided to notice her again.

"Not worship so much as respect," Aissur Aissur Rus said, "and truly the deeds of the Great Ones deserve—no, demand—respect. The more we learn of them, the more we seek to emulate them, to restore our sphere to the grandeur it once knew."

To bring about the conditions that caused the Suicide Wars, whatever

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those were, Jennifer glossed mentally, with a slight internal chill. Aloud, she said, "Then you don't really believe the Foitani you call the Great Ones live inside those hills?"

"Not now," Aissur Aissur Rus said. Before Jennifer could do more than start to frown, the Foitan went on, "But once they did. Those are not natural hills. Once a city stood there. We've mined it for millennia."

Jennifer glanced over to the hills once more, this time with fresh eyes. They still looked big enough and permanent enough to have been in place for millions of years. And this was after—how long had Thegun Thegun Nug said? —28,000 years, that was it, of neglect and erosion. She tried to imagine the towers that must have existed before earth and plants and time had their way with them, tried and failed.

"Odern was but a minor world in our former sphere," Aissur Aissur Rus added. "Others have remains far grander and far better preserved. But most of those worlds are dead, of course."

"Of course," Jennifer echoed softly. That internal chill grew and spread as she thought about what living as the scattered survivors of the galaxy's biggest slaughterhouse had to be like for the Foitani. No wonder they didn't have much of a sense of humor.

"Now come with us," Thegun Thegun Nug said. "We have reported our success to our kin-group chiefs. They and we will presently acquaint you with the other human in our employ."

The other human— Jennifer had forgotten about him. Of itself, her hand went to the stunner she still wore on her belt. It was no more than an annoyance to the Foitani, but the first time she saw this other human, she intended to flatten him—and to kick him while he was down, too.

The spaceport tarmac was full of big, blocky-looking Foitani ships. A couple of kilometers away, almost hidden by one of them, she saw a vessel that had to be human-built. It was the sort of medium-sized, medium-slow ship a trader who worked solo might fly. "He'll be *so* low, all right, when I'm through with him," she said under her breath.

Like the ships, the spaceport buildings were on what was to her a heroic scale. Foitani who carried things that looked a lot more lethal than stunners stood outside doorways. They touched their left knees to the ground as Thegun Thegun Nug and his comrades went by. Even from that position of respect, their fathomless black eyes bored into Jennifer. She wondered if she really did prefer these dispassionate stares of suspicion to the longing glances men so often sent her way. Maybe not, she decided.

Inside the administrative center or whatever it was, Foitani tramped purposefully down corridors wide and tall enough to echo. Some were armed like the guards outside; others spoke into computers. They all went about their business with the serious intensity that seemed a hallmark of the species.

Thegun Thegun Nug stood outside a place marked by writing in the angular Foitani script. He spoke to the air. Jennifer did not know what he said; somewhere between the ship and here, he and his fellows had turned off their translators. The air answered, as unintelli-

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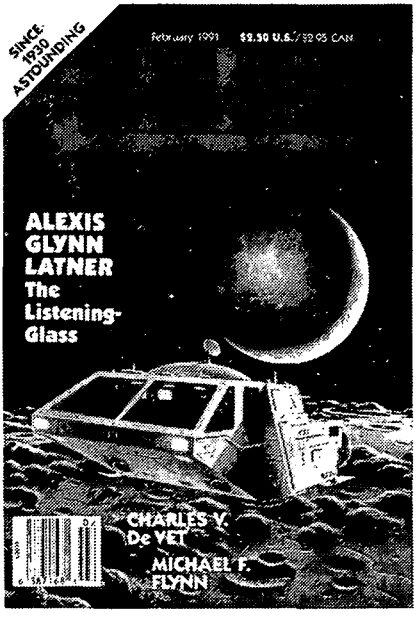

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gibly. Thegun Thegun Nug spoke again. One of those unnerving now-you-see-it, now-you-don't doors opened in front of him.

Jennifer had never been inside a spaceport operations center, but every third holovid drama seemed set in one, so she had some idea what they were like. This was definitely the Foitani version of such a nerve center. Big blue aliens talked into microphones, listened to odd-shaped headsets that accomodated their erectile ears, watched holographic displays. For a few seconds, no one paid any attention to Thegun Thegun Nug and his comrades.

Then a Foitan spotted Jennifer. He waved her captors toward what looked like another blank wall. By now she had learned blank walls didn't necessarily stay blank among the Foitani. Sure enough, this one didn't. A door appeared, this time opening onto what had to be the local equivalent of a boss' office. For one thing, it boasted carpeting, the first Jennifer had seen on Odern. For another, the desk behind which a Foitan stood seemed about as long and wide as the flight deck of an ancient aircraft carrier.

"You will pay your respects to Pawasar Pawasar Ras." Thegun Thegun Nug turned his translator back on as soon as the office door disappeared behind his party. He pointed to the Foitan behind the desk.

Jennifer nodded. "Hello, Pawasar Pawasar Ras." *If I had a stepladder, I'd spit in your eye.*

"I greet you, human," Pawasar Rawasar Ras said; Jennifer suspected that meant he was too important an executive to be bothered with remembering her name. "I trust your journey here was of adequate comfort."

You're pretty trusting, then, aren't you? was what she wanted to say. Since the Foitani who had kidnapped her already knew exactly how she felt about that, she kept her mouth shut.

Dargnil Dargnil Lin nudged her. A nudge from a Foitain was almost enough to knock her off her feet. "Answer the honored kin-group leader when he questions you," Dargnil Dargnil Lin said.

"I survived the journey," she said. Let this honcho make what he wanted of that.

Pawasar Pawasar Ras said, "You are doubtless of the opinion that you have seen a sufficiency of our kind." Jennifer's eyes opened wide: this was the first Foitan she'd met who had any of what humans reckoned common sense. Maybe it was rare enough in his species to make possessing it an automatic ticket to an important job like his. He went on, "Accordingly, I will let the human who has been working in cooperation with us explain the predicament he and we have encountered."

He touched something on his desk. A door appeared in a different wall of the office. Jennifer waited grimly. Whoever had set her up for this would have a lot more explaining to do than Pawasar Pawasar Ras thought. He might even find himself in a brand new predicament of his own.

A man dressed in trader coveralls came through the doorway. Jennifer stared. She'd expected to know the fellow who had betrayed her. She'd never expected he'd be someone she liked. "Bernard!" The academic part of her dredged up a stupid Middle English

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joke: "What's a nice guy like you doing in a place like this?"

Bernard Greenberg looked sheepish, although the top of his head was singularly devoid of wool. "Hello, Jennifer," he said. "I'm sorry. I didn't think they'd just up and grab you."

"Well, they bloody well did," she said, then added bitterly, "Were you so angry at me for going off to the university instead of staying a trader that you decided to get even? This isn't even; this is overkill."

"No, no, no." He plucked at his salt-and-pepper beard in distress. "It's not like that, Jennifer, really it's not. I thought they'd consult you. When they told me they were going to bring you here, I tried as hard as I could to talk them out of it. But their ship had already left for Saugus by then, and even if it hadn't, it's not easy to talk a Foitan out of anything. You may have noticed that."

"Now that you mention it, yes," she said with a sidelong glance at Thegun Thegun Nug. She studied Bernard Greenberg and decided she'd made a mistake. "I should be the one who says I'm sorry, Bernard. It's not your fault—not all your fault, anyway. I just hit out at the first thing I could reach without climbing onto a box." She looked at Thegun Thegun Nug again. His translator was working, but if he caught what she'd meant as well as what she'd said, he gave no sign of it.

Pawasar Pawasar Ras said, "Enough, if you please: this is not an appropriate time or place for social intercourse. Human Bernard, be so good as to define the problem for your colleague here." *He knows* Bernard's *name*, Jennifer thought with what she knew to be a completely irrational stab of jealousy.

"If I could define the problem, honored kin-group leader Pawasar Pawasar Ras, I wouldn't need a colleague," Greenberg answered. Pawasar Pawasar Ras bared his teeth. Jennifer knew that was only a Foitani frown, but it carried more impact than anything a human could do. Greenberg turned back to Jennifer: "You know the Foitani are past-worshipers and scavengers both."

She nodded. "Given what they did to themselves so long ago, it's hardly surprising."

"No, it isn't. The local population on Odern has mined the planet pretty thoroughly, when you consider how much of what used to be here has to have rusted away or whatever over the past umpty-thousand years."

Not enough, Jennifer thought. By the way Greenberg's mouth narrowed and lengthened ever so slightly—it wasn't a smile; it wasn't even close to a smile—Jennifer knew he'd picked up what she was thinking. No nonhuman would have noticed a change in his expression. She said, "I'm still not clear what this has to do with me."

"Scavenging turned into a whole different game for the local Foitani when they reinvented the hyperdrive," Greenberg said. "They had some idea which stars held planets their species had settled once upon a time. When they went out to look at those planets, they found that a lot of them were dead. Some had no Foitani left, some had no life at all—sterile. Fission bombs, diseases, asteroid strikes, poison gas—I don't know what all. The old imperial Foitani—"

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"The Great Ones," Pawasar Pawasar Ras corrected.

"The Great Ones, I mean—well, they seem to have had a more advanced technology than we do now. They were great at killing, that's certain. And on a lot of those dead worlds, the toys they left behind survived in much better shape than on a place like Odern, where everything got reused over and over again as the world was sliding into barbarism. Now, on one of the planets that used to be part of the empire, they've come across something they can't handle."

"They said that themselves," Jennifer said. "They didn't explain it, though—they haven't explained much of anything. So what exactly are you talking about?"

"They've found an artifact they cannot try to use and stay sane. If they're within ten or twelve kilometers of it, they can't help trying to use it, either, whatever the hell it is. I've seen dozens of the poor bastards who tried. They aren't pretty. The ones on the fringes of the effect around the thing can fight the compulsion, but if they get too close, they're doomed. Finally they lost enough people to make them fortify the whole area. But they were still curious, so they hired a non-Foitan—me—to see what he could find out."

"And you went crazy, too," Jennifer said, "or you never would have given them my name."

Pawasar Pawasar Ras's eyes swung sharply toward Greenberg when Thegun Thegun Nug's translator turned that into the local language. "Does the other human speak accurately, human Bernard? Has the Great Unknown" —even with the translator, Jennifer could hear the capital letters— "affected your psychological integrity?"

"I do not think so, honored kin-group leader Pawasar Pawasar Ras," Greenberg answered. Jennifer had finally managed to get his goat; he gave her a dirty look as he went on, "You may have noticed that humans use irony more than Foitani do."

"This business of saying one thing while meaning another is rank, manifest foolishness," Pawasar Pawasar Ras said.

"As may be." Greenberg sounded used to soothing Pawasar Pawasar Ras every so often. He turned back to Jennifer: "I couldn't find anything about this artifact that would make anybody go insane, human or Foitan. If it's not a physical effect, what's left? Best bet, I figured, was something cultural. I've been a trader a long time; I know something about that sort of thing. But you know more. Not only do you have your trader background, you've got a working knowledge of all the hypothetical cases your old-time writers invented. And the more I dealt with this thing, the more hypothetical everything about it looked, if you know what I mean. So I mentioned your name to the Foitani."

The worst part was, it made sense. Jennifer tried to stay angry, failed. She let out a long sigh. "And they took the ball and shot it toward the far goal. That does seem to be the way they do things."

"It certainly does." Greenberg cocked his head at her. "Shot the ball toward the far goal? I didn't know you followed battleball."

"An acquired taste. It's wearing off, believe me. Now that I'm here, there

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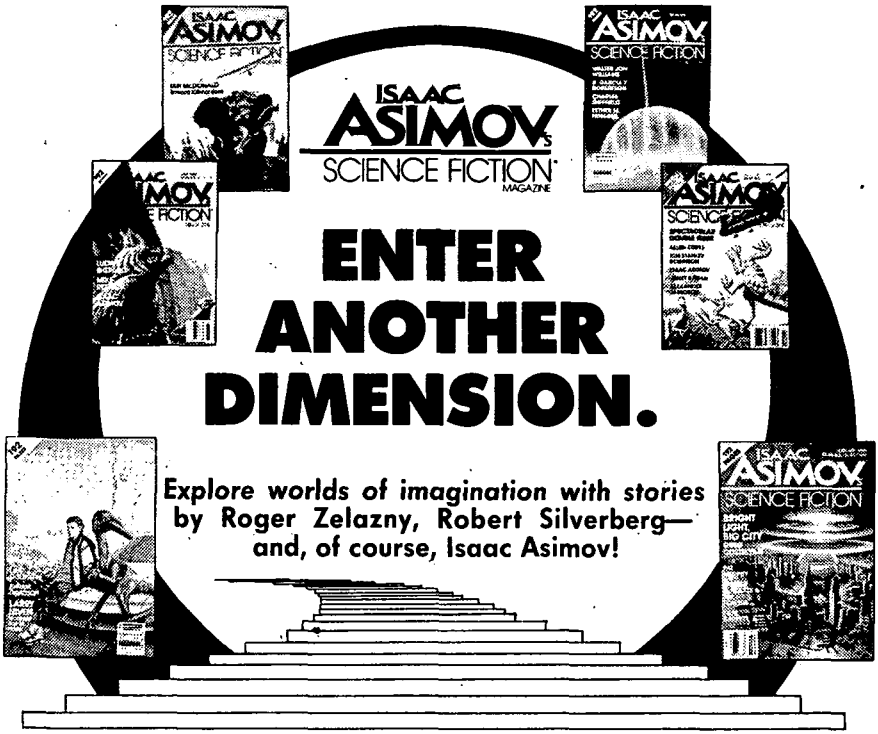
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isn't any good way back without going along, is there?" She turned to Pawasar Pawasar Ras. "All right, where next?"

"To the world Gilver," he answered with almost robotic literality. "This is the world upon which the Great Unknown is situated."

"Any chance for research first?" she asked: she *was* an academic before anything else. "You've been studying your ancestors ever since the, ah, Suicide Wars. Did they leave behind any records that might help you understand this thing?"

"That is an intelligent question." Pawasar Pawasar Ras's ears twitched, so he was genuinely pleased. "We have not found any data related to the world Gilver that pertain to it. Dargnil Dargnil Lin here can assist you in examining our data bases, if you think that would be valuable. He is expert in the ancient archives."

"I would like to see them, yes," Jennifer said. She wondered if Dargnil Dargnil Lin was an exception, or if steady, solid, serious types among the Foitani gravitated toward jobs like archivist as they did with humans.

"See to it, Dargnil Dargnil Lin," Pawasar Pawasar Ras said.

"It shall be done, honored kin-group leader," Dargnil Dargnil Lin replied.

Striking while the iron was hot and the big boss in a cooperative frame of mind, Jennifer said, "I saw Bernard Greenberg's ship here at this spaceport, honored kin-group leader." (If she was going to butter up Pawasar Pawasar Ras, might as well get him good and greasy.) "May I stay aboard it? A human ship truly would be a more proper base for me." (*And thanks to you, I'll never, ever keep a dog.*)

"If the human Bernard does not object, you may do this," Pawasar Pawasar Ras said.

"I don't object," Greenberg said at once.

"Then you may make those arrangements, human," Pawasar Pawasar Ras said to Jennifer—he still didn't have her name. Though Foitani eyes were next to impossible to read, she felt his gaze intensify as he went on, "Do not think this will permit you two humans to plan a joint escape. Aside from the dangers inherent for non-Foitani flying through space once in the Great Ones's sphere, we have our own tracker and explosive device secured in the—the—what is the name of your ship, human Bernard?"

"The *Harold Meeker*, honored kin-group leader," Greenberg said.

"Yes, the *Harold Meeker*. Very well, then, human, ah—"

"Jennifer." *Took him long enough to ask*, Jennifer thought.

"Yes, Jennifer. You may proceed, then, human Jennifer, with your researches for a period not to exceed, ah, twenty Odern days, Dargnil Dargnil Lin to assist you as necessary. Then you and human Bernard shall travel to Gilver to continue in the attempt to analyze the Great Unknown. Thegun Thegun Nug, Aissur Aissur Rus, Dargnil Dargnil Lin, and I shall accompany you there."

Jennifer had expected the other three Foitani to go offworld with her if she left Odern. They were plainly her keepers. But Pawasar Pawasar Ras surprised her by including himself. From what she knew of big-wheel executives, they didn't often inflict themselves on actual

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research sites. "Why you?" she asked him.

"The Great Unknown is my project," Pawasar Pawasar Ras said, as if that explained everything. To him, it seemed to. To Jennifer, it showed the Foitani definitely were not human—not that she hadn't noticed that already.

Jennifer finished a salami sandwich. The meat was greasy, the bread bland. The mustard was tangier than she cared for. She washed down the sandwich with a glass of *vin* extremely *ordinaire*. After Foitani rations, it all tasted wonderful. "Thank you, Bernard," she said. "I just may live. I may even decide I want to."

"Sorry there isn't more and better," Greenberg answered. "I've been in Foitani space long enough that I'm starting to run low myself."

"And I'll make you run out all the faster. I'm sorry."

"Don't be. You always did apologize too much; do you know that? If I hadn't opened my big mouth, you'd still be happily back on Saugus. Sharing real food with you is the least I can do to pay you back. We won't starve on what the Foitani eat—"

"—However much we wish we would," Jennifer finished for him.

He studied her, one eyebrow raised. After Ali Bakhtiar's virtuoso displays of superciliosity, this was amateur night. The master trader said, "You've changed a bit since we flew together a few years ago. Then you wouldn't have interrupted or made sour jokes."

She shrugged. "I've finished growing up. I find I can manage all right for myself. Now to business, if you don't mind, because I don't want to spend one more second here than I have to. First off, is your ship bugged?"

"I assume so. Pity we don't know some arcane foreign languages we could use to talk privately," Greenberg said. Jennifer gave a rueful nod. Nobody bothered to learn to speak foreign languages these days, not with oral translator programs so widely available. She supposed she could make a stab at speaking Middle English, but the Foitani were more likely to understand her than Greenberg was.

"What is this Great Unknown thing, anyway?" she asked.

"If I knew, I would tell you," he answered. "If I knew we could go home, come to that. But I don't know. I just hope we'll be able to find out. I keep worrying about what the Foitani may do if we can't—and we may not be able to. Nobody who isn't a Foitan has any real notion of what their ancestors were capable of, back before the Suicide Wars. I told you, though, it's pretty clear they were technologically ahead of where we are now."

"That won't help us understand them." Jennifer slowly shook her head. "They may have been ahead of us technically, but socially—! Think of spending however many thousands of years they took to build up their empire, and then to blow it to bits, and themselves with it." She shook her head again, this time in horror. The Foitani seemed to have lived out every human's darkest nightmares.

Greenberg said, "To this day, they don't know why they started to fight. But once they got going, they did a good, thorough job, which is typical of

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the species. Pawasar Pawasar Ras says they undoubtedly intended to kill themselves off altogether; in a crazy sort of way, he thinks less of them for failing."

"The worst part of it is, now that I've been around Foitani a while, I can almost see the logic in that." Jennifer started to say something more, but found herself yawning instead.

"You may have more privacy aboard one of their ships, or in the spaceport," Greenberg said. "You'd certainly have more room. This isn't a big ship at all."

"If you want me to leave, I will. Otherwise I'd sooner stay here." Jennifer said. "I don't need a whole lot of privacy from you, do I? After all, we've flown together before."

"I'll set you up with a foam pad in the storeroom." Greenberg spread his hands. "I'm sorry, but that's the best I can do if you want any room to yourself."

"Drag the pad in here tonight, would you? After getting lifted the way I did, just being close to somebody human will feel good. I don't think you're going to molest me."

Greenberg grinned lopsidedly. "Tempting as the notion is—no." He rummaged in a compartment, pulled out the promised foam pad. Except for being smaller, it was identical to the one on which she had awakened inside the Foitani ship. Greenberg rummaged some more, let out a grunt of triumph. "I thought I had a spare pillow in here. And here's a blanket, too."

Jennifer took them. "Thanks. But do you know what the biggest pleasure being aboard your ship will be for me?" Without waiting for Greenberg to reply, she went on, "Having a toilet that fits my behind."

He laughed at that. "Yes, I've seen what the Foitani use. They'd be especially bad for you, wouldn't they?" He waved toward the refresher cubicle. "Help yourself."

"I don't mind if I do." She hesitated, then asked, "You wouldn't by any chance have tampons or anything like that?"

"I don't know if there are any in the sanitary supplies or not. I never needed to find out until now."

"Well, if you don't, I suppose I can improvise something or other. I did it once; I can do it again."

When she got out, Greenberg went in. She stripped down to her underpants, gave her grimy outfit an unhappy look, and then brightened—the *Harold Meeker* would be able to get clothes *clean*, not just stir the dirt around as she had been doing. She slid under the blanket.

Greenberg surprised her by stooping next to the foam pad and reaching out to touch her shoulder. She stiffened. Was he going to make advances now? She'd made love with him a few times on their first trip together—hardly surprising, in a four-person crew without married couples. But this was *not* the time, not for her. She tried to figure out how to tell him that without hurting him or making him angry.

But all he wanted was to apologize again: "Jennifer, I'm so sorry. You should be back on your campus, doing what you wanted to do."

"It can't be helped," she said. Her dreams of elaborate revenge had collapsed when she found out how the Foitani learned of her, and from whom.

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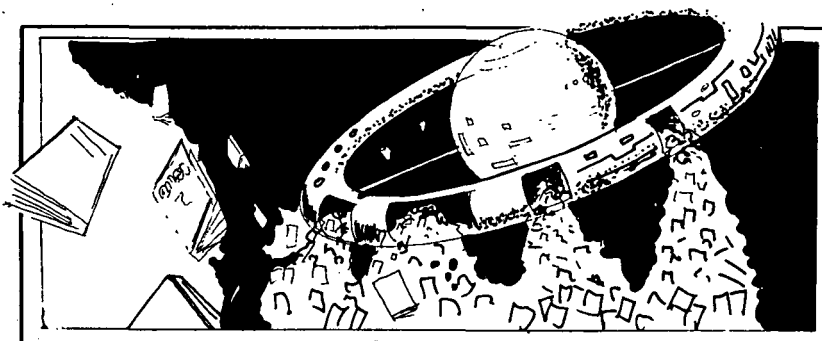

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While they lasted, though, they'd helped sustain her. With nothing in their place, she felt very tired. "Just let me sleep."

"Fair enough." Greenberg rose; Jennifer's eyes closed even as he did so. She heard cloth whisper when he pulled off his coveralls, then the muffled sound his body made pressing against the sofabed. He must have touched the light switch, for the darkness behind her eyelids got blacker. "Goodnight," he said.

She thought she answered him, but she was never sure afterwards.

Dargnil Dargnil Lin stood in front of a workstation. It had all the elements of the ones with which Jennifer was familiar—holoscreen, mike, keyboard, printer—yet was in aggregate nothing like them. The Foitani had their own engineering traditions, which owed nothing to those of mankind.

"I suppose you will want to begin with our records pertaining to the Great Unknown," Dargnil Dargnil Lin said.

"I'd rather have more background first, if I could," Jennifer answered. "Can you show me something basic and general about your race as it was before the Suicide Wars?"

"Your time for research is limited." The translator was expressionless as always, but Jennifer thought she heard a sniff in the Foitan's voice. She looked up at him without saying anything. He bared his teeth at her. She kept waiting. At last he said, "Let it be as you wish, then." He spoke to the workstation. The screen lit. Dargnil Dargnil Lin said, "This is a history such as our adolescents use."

"Good." The video had more text to it than a comparable human one would have used, and Jennifer could not read the Foitani written language. But there were still plenty of pictures, and Dargnil Dargnil Lin's translator turned the sound track into Spanglish for her. She watched and listened, and spoke low-voiced notes into her computer.

On a historical star-atlas, she watched the empire of the Great Ones spread. The sound track attributed their unbroken run of success to their inherent superiority over all the races they encountered. She wondered whether the species was biologically programmed to think that way, the Foitani of Odern were imitating their ancestors, or if they were projecting their own attitudes back onto the Great Ones.

A few minutes of watching made her toss out that last possibility. The Foitani of long ago had had the habit of killing off races that proved obstreperous. They did not bother to hide or even to go out of the way to justify genocide; they simply went about it, with second thoughts as few and far between as if they were swatting flies.

"Can you stop the tape for a moment?" Jennifer said. Dargnil Dargnil Lin could. Jennifer asked him, "Would your people act that way again if you were strong enough?"

"Probably," he said. "We have not reached the heights the Great Ones achieved, however, and races such as your own appear more potent than any they faced. Thus we have had to begin to learn to deal with other species rather than simply rolling over them. It is not easy for us."

Jennifer bit back the sardonic retort that automatically came to mind. The

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Foitani could not help being what they were. Expecting aliens to act like humans was the easiest way for a trader to get into trouble. Moreover, mankind could not boast a spotless record among the stars, though humans had perpetrated their worst acts of savagery on themselves.

The same seemed true of the Foitani. The screen Jennifer was watching suddenly turned a dazzling white. She staggered back, hands to her eyes, as if caught by the blast of a real explosion. When she looked again, a phrase in the Foitani written language filled the screen. "The Suicide Wars," Dargnil Dargnil Lin read for her.

"I'd suspected that, yes," Jennifer murmured. Far more rapidly than it had grown, the Foitani empire crumbled. Most of the stars that had filled the holovid map went dark. A handful, scattered at random across two or three thousand light-years, kept glowing red. An even smaller handful burned with a yellow light.

"Those yellow dots are the worlds of our species that have relearned starflight," Darngil Dargnil Lin said. "On the red, Foitani also survive, but in a state of savagery."

"But *why* did it happen?" Jennifer asked. "What made you fight like that?" The tape hadn't offered a clue; its narration merely recorded the event without analyzing what had brought it on.

"I cannot answer, nor could anyone on Odern," Dargnil Dargnil Lin said. "Who can hope to see into the minds of the Great Ones? Only when we can match their deeds will we be worthy to comprehend their thoughts."

Jennifer's mouth twisted in discontent. The Foitani were too busy venerating their past to try seriously to understand it. "May I speak without causing offense through ignorance of your customs?" she asked, one of the standard questions every trader learned.

"Speak," Dargnil Dargnil Lin said.

"If the Great Ones were as magnificent in every way as you make them out to be, why did they ever go and fight the Suicide Wars in the first place?"

"For reasons of their own, reasons which surely reflected their greatness," Darngil Dargnil Lin answered. Jennifer filled her lungs to shout at him; that was less than no answer, for it shunted aside thought rather than inspiring it. But the Foitan was not through: "Some among us have speculated that the Great Unknown contains the full and proper response to your question, and that our failure to grasp merely reflects our degeneracy in comparison to our ancestors."

"That's—" Jennifer stopped again. How did she know it was nonsense? She was no Foitan (*thank God*, she added to herself). She tried again. "That's interesting. What evidence do your scholars apply in support of it?" The idea of the Foitani of Odern as decadent descendants of the true race had a nasty appeal to her, not least because it made their behavior in snatching her the product of debased minds.

Dargnil Dargnil Lin said, "I will show you a tape and let you draw your own conclusions."

"Show me several tapes, ones with differing points of view. How can I decide what is true on the basis of a single report?"

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"You are a scholar," Dargnil Dargnil Lin said, as if reminding himself. "Very well, let it be as you wish." For the next several hours, Jennifer viewed records of the Foitani discovery of the Great Unknown, and of speculations about it. When she was through for the day, she mentally apologized to the big blue aliens. She'd thought them too staid to produce much in the way of crackpottery. Now she knew better. Given the proper stimulus, they could be as bizarre as any human ever born.

The Great Unknown was proper enough. She studied orbital photos, then others taken at long range from the ground, and finally closeups. "Those were obtained by remote-controlled cameras," Dargnil Dargnil Lin said of the last batch. "We have a great store of data, as you see. They do not lead us toward understanding, however."

The old Foitani seemed to have gone in for monumental architecture in a big way. Massive colonnades led toward an enormous column that leaped most of a kilometer into Gilver's sky. No weeds, no undergrowth marred the Great Unknown or its precinct, even after 28,000 years. Nor had Gilver's tectonic forces damaged either tower or colonnades. They might have been raised yesterday rather than in the late Pleistocene.

"Why didn't this thing get bombed along with the rest of the planet?" Jennifer asked.

"Something else we do not know," Dargnil Dargnil Lin said. "For your knowledge base, though, you should also observe some of the first of our people to come close enough to the artifact to feel its effect." He spoke into the microphone again.

After a few seconds of viewing, Jennifer had to turn away. Greenberg had been right; the Foitani who got too close to the Great Unknown weren't pretty. They hadn't just been damaged—they'd been destroyed. They drooled and shook and sucked on their toes and relieved themselves wherever they happened to be. Their muzzled faces gave not the slightest indication of surviving intelligence, nor could Darngil Dargnil Lin's translator make sense of the shrieks and growls that sprang from their throats.

"This happened to *all* your people who got too close?" Jennifer asked, gulping.

"All. The precise radius at which the Great Unknown began to grip them varied with the individual, but within it no one was safe."

"Hmm." Jennifer thought for a while. "And we know this didn't happen with Bernard. Does it happen to Foitani from worlds other than Odern who come to Gilver?"

"We do not know," Dargnil Dargnil Lin said. "We do not want to find out. To an alien such as yourself, all who still inhabit the Great Ones's sphere may rightly be known as Foitani. Well and good. But those who spring from other worlds are untrustworthy at best and outright abomination at the worst. Only we of Odern are the true descendants of the original race."

"Oh, my aching head," Jennifer said softly.

"Your head still distresses you? Perhaps it is an aftereffect of the ray Thegun Thegun Nug used to stun you. I hope you have an analgesic available."

"Never mind," Jennifer said, not surprised the translator had been too lit-

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eral. All the surviving Foitani had been separated from one another for more than 20,000 years. No wonder they'd have trouble getting along. After so much time, they wouldn't even all be of the same species any more. She asked, "When you deal with these other Foitani, what language do you use?"

"That of the Great Ones, so far as we understand it. It is the only speech we have in common, after all. Some worlds, among which Odern takes the lead, also use this tongue in everyday life in place of our former degenerate jargons. Others barbarously insist on maintaining the primitive language they employed before coming into contact with more civilized Foitani."

"All right; thanks. I think I've seen enough for today, if that's all right with you." What with the spectacle of completely deranged Foitani and the realization that the Foitani of Odern were just one small part of a much bigger puzzle, Jennifer was sure she'd seen enough.

Bernard Greenberg clapped a rueful hand to his forehead when she told him what she'd learned. He said, "I should have thought of that. It's too easy to forget how long they spent isolated on their own planets."

"With luck, it won't matter," Jennifer answered. "After all, the Foitani from Odern are the only ones who know about Gilver, so they'll be the only ones we have to worry about."

"I suppose so," Greenberg said. "But if they learned of the place from records they dug up, there's always the chance some other bunch will too."

Jennifer had tried not to think about that. "Bite your tongue."

The more she researched the Great Unknown, the more she concluded that was a good name for it. Fusion bombs had all but sterilized Gilver. They'd fallen all around the mysterious artifact, but not a single one had landed inside what she'd taken to calling the radius of insanity. The planet's ecosystem was still struggling to repair itself; parts of that continent had become almost lush with greenery. Within the radius of insanity, nothing grew. Mere life, apparently, was not allowed to disturb the Great Unknown.

"I can imagine achieving that effect for a limited time, with periodic maintenance," Dargnil Dargnil Lin said when Jennifer asked him about it. "But to continue since the Suicide Wars . . . no, human Jennifer, it is but another of the wonders the Great Ones left behind for us to marvel at."

Jennifer was sick of marveling at the Great Ones. She wanted answers, and the Foitani records on Odern held precious few of them. "I never would have believed it," she said when her last allotted research day was done, "but I'll be glad to go to Gilver, just to try and figure out what's really going on."

"More power to you, if you can do that on Gilver," Bernard answered. "If you think Odern is boring, you haven't seen anything yet."

"I haven't seen anything of Odern, except the spaceport and the library. Neither one of them is likely to drive Terra or Redford's Star off the tourist itineraries."

He smiled at her. "You've changed; do you know that? You're not nearly the same person you were when you

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flew with me aboard the *Flying Festoon*."

Jennifer mentally prodded herself. "It hasn't been that many years, Bernard. I don't feel different in any particular way."

"You are, though. Back then, when anybody said anything to you, you were as like as not to pull back into your shell and not even answer. You don't back away any more; you're a lot surer of yourself than you used to be."

"Am I?" Jennifer thought about it. "Well, maybe I am. I'm older now, after all. I was just a student when I took my first trading run." She laughed, mostly at herself. "All I wanted to do was get something out of the ordinary on my vita. I did that, all right. I've been to places most Middle English professors would run screaming from. Come to think of it, I wouldn't blame them. If I thought it would do any good, I'd run screaming out of here."

"It wouldn't do any good. But Odern is lively, next to Gilver. Here at least you have a whole planet full of people doing all the normal things people do. There are only two kinds of people —well, Foitani, but you know what I mean—on Gilver. They have soldiers, to guard something nobody else is supposed to know about, and they have scholars, to try to understand something they don't dare approach. Aissur Aissur Rus is from Gilver—he was the head of the research team there."

"I like him better than a lot of the others," Jennifer said.

"Yes, he's sharp," Greenberg agreed. "He thinks for himself, and that's unusual among the Foitani. They usually just go around trying to figure out what the Great Ones would have done. I suppose that's one of the reasons he got the job. Nobody here had any idea what the Great Ones were doing with the Great Unknown, so they had to get someone who could put his own slant on things. But that's not the point I was trying to make. Aissur Aissur Rus was so glad to get away from Gilver that he volunteered to be part of the team that brought you back here."

"That's great," Jennifer said. "But he's going back there, with us, isn't he?"

"So he is, but I don't think it's because he really wants to. The Foitani run more toward a strong sense of duty than we do."

"After what they put themselves through with the Suicide Wars, it sounds like a survival characteristic for them. To pull themselves back up after something like that, they'd have to have been able to stick together."

"I suppose so." Greenberg yawned. "We'd better get some sleep. If your research is done, we'll probably be leaving for Gilver early tomorrow, or maybe even late tonight. The Foitani don't believe in wasting time. They could be in here any minute now, to install the course tape and the electronic countermeasures they hope will get us there without being blasted by something left over from the Suicide Wars."

"Of course, they have their own bomb aboard already," Jennifer said.

"There is that, yes. But we don't have to worry about it as long as we're good little boys and girls." Greenberg's voice was dry.

"That's great," Jennifer said again. She walked into the refresher cubicle.

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When she came out, Greenberg went in. She undressed, lay down on the foam pad (it never had got moved to the storeroom), pulled the blanket up over her. She closed her eyes, but discovered that, though she was tired, she wasn't ready to sleep. The faint ammoniacal smell of the foam pad reminded her of the one she'd had on the Foitani ship, which in turn made her feel all over again how very much alone she was. But for Greenberg, she was the only human for too many hundred light-years. The *Harold Meeker*'s temperature was perfectly comfortable. She shivered under the blanket even so.

Greenberg came out of the refresher. He yawned again, stepped toward his sofabed. If he had any worries like Jennifer's, he didn't show them. She suspected they were there; back aboard the *Flying Festoon*, he'd been good at keeping things to himself so his worries wouldn't worry others. It was one of the several traits for which she admired him.

She nodded to herself. "Bernard," she called softly, "do you really feel like sleeping right away?"

He stopped in midstride. His voice was controlled, careful when he answered, "Does that mean what I think it means?"

She nodded again, this time for him. "I think it means what you think it means."

"Jennifer, any man who didn't want to go to bed with you the minute he set eyes on you would need his vision correction adjusted. You know that," Greenberg said. Jennifer did know it. The knowledge had not always brought happiness; men found it too easy to separate her body from her self, to want the one without caring about the other. But Greenberg was going on: "We have enough other things to worry about right now, so I want to know if you're sure. If it's going to complicate our lives a lot, it's more trouble than it's worth."

"If you have the sense to say something like that—and I was sure you did—then we should be able to manage, don't you think?"

"I hope so," he answered. He pulled off his shorts. The cabin of the *Harold Meeker* was small; two quick steps brought him to the foam pad. He got down beside her. She wadded up the blanket, threw it against the wall. He smiled. "I forgot just how lovely you are. I'd sort of kept from looking at you a lot—I didn't want to make a nuisance of myself, or more of a nuisance than I've already been for getting you dragged to Odern in the first place."

"That's foolish," Jennifer said. "It's not as if we haven't seen each other before. Trading ships are like that. And we're friends already, and more than friends, even if it was a while ago now."

"Quite a while ago now. I didn't want to impose, and you were still upset about being here. But—" He didn't go on, at least not with words.

Jennifer savored what he was doing. She remembered from the *Flying Festoon* that he was seldom in a hurry (a rare virtue, she'd since found). Since he was about fifteen years older than she was, she wondered if it was just that he was more thoroughly mature. More likely, it was that he was simply himself. Whatever it was, she enjoyed it.

A considerable while later, she arched

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her hips so he could slide down her underpants. "Be careful with them," she said. "I only have the two pairs, and yours aren't made for the way I'm put together."

"I like the way you're put together."

"I noticed." Her hand closed on him.

"And I'll be careful," he promised. "How's that—and that—and that?"

Her underpants had only got as far as her knees, but she didn't care. "Mmm. That's—nice. Oh yes, right there, right there—"

The communicator buzzed harshly. "Oh no," Jennifer said. Greenberg was a good deal more eloquent than that. The communicator ignored both of them. It kept on buzzing.

"Open your ship at once, humans. This is Pawasar Pawasar Ras speaking. I shall brook no delay." The electronic translator's tone was flat, but the words could hardly have been more peremptory. Pawasar Pawasar Ras went on, "We need to install important gear aboard the *Harold Meeker* immediately. Refusal to open the ship will be taken as evidence of conspiracy against the Foitan species."

"What do you suppose they do to conspirators against the Foitan species?" Jennifer asked.

Greenberg stroked her one last time. "I'm tempted to find out." But the moment was broken, and they both knew it. He got up from the foam pad, called out, "We will open the ship in a moment, Pawasar Pawasar Ras. You roused us from our rest, that's all."

"What rest?" Jennifer said. Then she giggled. "I was certainly roused, though."

"Shut up," Greenberg said over his shoulder as he dressed. She put her clothes back on, too. He ordered the airlock open. The alien, faintly spicy smells of Odern's air filled the cabin.

Two Foitani technicians came in. They filled the cabin too, to overflowing. They installed their gadgetry, ran some checks to make sure their artificial intelligence system meshed with the *Harold Meeker*'s computers. One of them wore a translator. He said, "If you try to disable this system, you will also disable your own electronics. If by some accident you do not do that, you will remain altogether vulnerable to weaponry from the days of the Suicide Wars. I tell you this for information's sake. You may die if you like, but you should be aware of how and why this will come to pass."

"Thank you for being generous enough to warn us," Greenberg said.

"You are welcome." Like most Foitani, the technician was irony-proof. "You will lift off as soon as is practicable, which is to say, at once."

Greenberg drew himself to attention, spoke to the air: "Commence liftoff sequence."

"Automatic checklist commencing," the ship's computer answered.

"Wait for us to leave this cramped vessel, you fool," the Foitani technician exclaimed. "We are not ordered to fly to Gilver." For once, Jennifer saw an agitated Foitan.

"Sorry. Computer, cancel liftoff sequence," Greenberg ordered. He turned back to the technician. "You did tell me to lift off at once, did you not?"

"Yes, but—" The Foitan gave up. Along with his companion, he hastily departed from the *Harold Meeker*.

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Greenberg grinned at Jennifer. "The best way to confuse them is to take them perfectly literally when they don't want you to. Only trouble is, they're so literal-minded themselves that you don't get as many chances as you'd like." The grin changed shape, just a little. "Which is true of other things as well. Where were we when we got so rudely interrupted?"

Jennifer stepped close to him, took his hand, guided it. "I think," she whispered, "you were right about here."

The trip from Odern to Gilver was about as long as the one from Saugus to Odern had been. Other than that, the two journeys held no similarity. This time, Jennifer had pleasant human company aboard a human ship. All the facilities were designed for her species; she'd been glad to discover that the *Harold Meeker*'s sanitary supplies did include tampons.

She studied the material Dargnil Dargnil Lin had taken from Odern's library. The Foitani of Odern did seem to be spiritual descendants of their long-destroyed imperial ancestors: they were stern, humorless, efficient, and basically unwilling to recognize other species as anything but creatures to be exploited. *I can testify to that*, she thought.

Nothing in the data gave her any great insight into the Great Unknown. If the Foitani thought she'd step off the *Harold Meeker* with the answer to their problem all wrapped up with a bow around it, they were going to be disappointed. She took malicious glee at the idea of disappointing them, glee tempered only by the realization that disappointed Foitani were also liable to be dangerous Foitani.

The idea of stepping off the *Harold Meeker* without the answer made something else occur to her. "What became of the *Flying Festoon*, Bernard?" she asked. "Why aren't you still flying it?"

"I sold it after that first trip you took with me," he said, shrugging. "Marya and Pavel both reached master status after that run, and they wanted commands of their own. I could have kept it and hired on some less experienced crewfolk, I suppose, but I didn't feel like it. So I sold it and got this smaller ship. I'm a jack of all trades and I like my own company pretty well, so I thought I'd make a few runs by myself. I was turning a profit till this mess with the Foitani blew up. If we can figure out the Great Unknown, I'll make one yet. So will you."

Jennifer sighed. She'd been a trader long enough that turning a profit was important to her, too. She wondered if it was important enough to mean she had to satisfy the Foitani after all. Maybe it was. If they kept their bargain and let her take her pay in trade goods, she was more confident than ever that she could squeeze them till their black ball-bearing eyes popped.

But she was not just a trader, and she didn't want to be a full-time trader. She spent a lot of time with her reader in front of her face, going through Middle English science fiction both to keep her grasp of the language sharp and to see if any of the science-fiction writers, with their elastic minds, had imagined a race analogous to the Foitani. That was a better hope than wading through the xenanthropology manuals: a glance there

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had told her what she already knew, that none of the other races with which humanity was acquainted resembled the blue-skinned aliens at all. Besides, Middle English was more fun to read than the manuals.

"Any luck?" Greenberg asked hopefully when she came up for air one day about halfway through the trip to Gilver.

She had to shake her head. "Nothing so far."

"Keep looking. I know how I used to sneer at you for reading that stuff, but the ideas you got from it really came in handy on L'Rau."

"I used ancient literature to help me on Athet, too: Sherlock Holmes it was that time, not properly science fiction at all. As somebody—Niven, I think it was—said back in the twentieth century, abstract knowledge never goes to waste."

Greenberg knew something about the twentieth century, but not enough. "Niven? I thought he was an actor, not one of your writers." The misunderstanding took several minutes to clear up. Finally Jennifer projected pictures of both men. "No, they're definitely not the same fellow," Greenberg admitted.

"There, you see?" she said. "They —" She stopped with a squawk, grabbed for the back of the sofabed—the *Harold Meeker* was lurching under her feet as if caught on the ground during an earthquake. She felt the hair on her arms and at the back of her neck prickle up in alarm. Ships in hyperdrive had no business lurching. What was there to run into?

The viewscreen had been dark all through the journey; in hyperdrive, what was there to see? It was dark still, but dark in a different way, dark with the velvety blackness of space. A couple of stars gleamed, like tiny jewels set on the velvet.

Greenberg and Jennifer stared at each other. "Status report!" he snapped.

"Ship has returned to normal space," the computer answered. "Reason unknown."

They looked at each other again, this time fearfully. If they couldn't get back into hyperdrive, the way home was laser driver, light sail, and frozen sleep. Inside human space, that was feasible; every human planet listened for rescue beacons and maintained rescue ships. Starting out from somewhere in the middle of the Foitani sphere, though, they could travel for ten thousand years before they ever got back to the edge of human space.

"Condition of hyperdrive engine," Greenberg said urgently.

After a moment, the computer reported, "All systems appear to be performing satisfactorily. The hyperdrive, however, is not functional."

Greenberg made hair-tearing gestures. Jennifer stifled a nervous laugh —she wondered it he'd really pulled his hair before he went bald. Just then, what looked like a supernova blossomed in the viewscreen. Jennifer threw up her hands to protect her eyes. "Radiation!" the computer screeched. "Protective screens" —a pause of several seconds— "holding."

The flat voice of a translator came from the comm speaker: "Foitani ship *Horzefalus Kwef* to human ship *Harold Meeker*. You may proceed in normal operation."

"First tell us what the hell just hap-

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pened," Greenberg said. His own voice was shaky; Jennifer blamed him not at all.

"We have successfully destroyed a hyperdrive trap that dates from the days of the Great Ones. As soon as a ship is forcibly returned to normal space, a normal-space missile left behind in the area homes in on it. That missile is now detonated. You may proceed."

For the third time in a couple of minutes, Jennifer and Greenberg stared at each other. She was not surprised that he found words first: "There's no way you can pull a ship straight out of hyperdrive like that!"

"On the contrary," the Foitan aboard *Horzefalus Kwef* answered: "there is a way. You have just seen it demonstrated. Our science has not succeeded in reconstructing what that way is. I gather from what I infer to be your surprise that human science has not either. But the Great Ones knew. I tell you once more, you may proceed. Failure to do so will be construed as lack of good faith."

"We're going, we're going," Greenberg said. He gave the computer the necessary orders. The *Harold Meeker* had no trouble returning to hyperdrive. Greenberg gaped at the blank black viewscreen, shook his head. He spoke to the computer again: "Save multiple copies of all data pertaining to this incident."

"It shall be done," the computer said.

Jennifer said, "Just knowing that a hyperdrive trap is possible is going to drive human engineers crazy for years. Nobody's ever even imagined such a thing. And you'll have the only tapes of one in action." The *Harold Meeker* was his ship; they were his tapes. Trading Guild regs spelled that out in words of one syllable; she was just a passenger here.

"*We'll* have," he corrected. "I wouldn't try to go all regulation on you. You wouldn't be in this mess if it weren't for me. And besides . . . those tapes have enough money in them for a lot more than two people."

"You don't have to do that," she said. "I never was in trading for the money. And all the same, I'm a long way from broke."

"You're also a long way from home, and that's my fault. Computer, log that any profits from tapes of the hyperdrive trap will be divided equally between journeyman trader Jennifer Logan and me."

"Logged," the computer said.

Jennifer saw that any further protest would be worse than useless. "Thank you, Bernard."

He brushed that aside. "Let's just see if we can get back to human space to turn the tapes into money. Right now, I have to say that's rather less than obvious."

Some people would not have been generous at all. That wouldn't have bothered Jennifer; the tapes belonged to Greenberg because he was shipmaster. Some people would have been generous and then expected something—probably a lot—in return. Very few people were like Bernard Greenberg, to be generous and then act as if nothing had happened. She thought that was wonderful, and knew he wouldn't want her to say so.

The rest of the trip to Gilver was uneventful. The only misfortune that took

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place was running out of human-style food and having to go over to Foitani rations. Jennifer crunched away at her kibbles with a singular lack of enthusiasm. "No, a plural lack of enthusiasm," she said a few meals later, "because there are lots of ways I don't like them."

Greenberg answered with a snort. Wordplay wasn't one of his virtues, or vices. People had been arguing about that since the days of Middle English, and longer. Puns were what had started Jennifer reading Middle English science fiction in the original in the first place; Robinson, among others, was untranslatable into Spanglish because of them.

The hours followed each other, as hours have a way of doing. At last the computer announced that the *Harold Meeker* had reached Gilver's star system. The viewscreen went from blank blackness to velvety blackness; Gilver's sun blazed in the center of it. Gilver itself, a bright blue-green spark, shone in one corner. The computer swung the ship, boosted toward the planet on normal-space drive.

Alarms went off. "Missiles incoming!" the computer shouted. "Firing laser driver. Many hostile targets, converging on ship from many directions. Maneuvering to position laser driver. Firing . . . Maneuvering . . . "

"Human ship *Harold Meeker* to *Horzefalus Kwef*," Greenberg called urgently. "What the bloody hell is going on? I thought you people said Gilver was a dead world except for the Great stinking Unknown. Where are all these ancient missiles from the time of the Great Ones coming from?"

While he and Jennifer waited for an answer, the ship's weaponry blasted three missiles. But more bored in. Then those too began winking off the screen, some just vanishing, others exploding in spheres of radioactive fire. Jennifer found herself wondering about the *Harold Meeker*'s shielding, and wishing she were wearing something more protective than cotton coveralls cut down to fit her and thin synthetic underwear. A lead suit of mail might have been nice.

At last the *Horzefalus Kwef* deigned to reply: "Human ship, these missiles are not of Great One manufacture. We are under attack by elements of a fleet from the Foitani planet Rof Golan. These Foitani are vicious and treacherous by nature. They must somehow have stolen information that led them to Gilver. We shall endeavor to protect your feeble ship as well as—" The transmission cut off.

"Did they get hit?" Jennifer asked. She half hoped the answer would be yes. The *Horzefalus Kwef* might be protecting them from the Rof Golani ships, but if it was gone they could try to head back to human space. The Foitani electronics aboard gave them some chance of making it in one piece.

But after checking the telltales, Greenberg said, "No, they're still there. The other ships are jamming their radio traffic. There they go, down toward the surface of the planet. I think we'd better follow them."

Regretfully, Jennifer decided he was right. The screen and the radar plot showed explosions and missiles all around the ship. The *Harold Meeker* was not built for war. The Rof Golani spacecraft plainly were; they had more acceleration and maneuverability than

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a peaceful ship would ever need. By the way it performed, *Horzefalus Kwef* seemed a match for them. Staying close to it seemed the best bet for survival.

Unintelligible words came from the speaker: a Foitani voice, but not one always calm and self-contained like those of the Foitani from Odern. This one screeched and cried and yelled. "What do you suppose he's saying?" Jennifer asked.

"Nothing we want to hear, and you can bet on that," Greenberg answered. He studied the radar plot. "There goes one of the bastards! And that wasn't a missile from *Horzefalus Kwef*, either. Our paranoid friends' ground installations have paid off after all."

"They certainly don't think much of other Foitani, do they?" Jennifer agreed. "And they do think this Great Unknown thing is worth protecting. They didn't want to get caught flat-footed if another Foitani world somehow found out about Gilver."

"Somebody has, all right," Greenberg said.

The viewscreen blazed white. Alarms yammered, then slowly quieted. "We cannot sustain another hit so close without serious damage," the computer warned. A moment later, it added, "Entering atmosphere."

Atmospheric fliers swarmed up from the base on Gilver. With the fight so close to the planet, they were of some use against spacecraft. Jennifer found herself cheering when one of the attacking ships blew up in a burst of supernova brilliance. She stopped all at once, surprised and a little angry at herself. "I never thought I'd be yelling for the miserable folk who kidnapped me," she said.

"When they're helping to save your one and only personal neck, that does put a different slant on things," Greenberg answered.

"So it does," she said, glad he understood and also impressed that he could preserve his wry perspective when they might turn to radioactive incandescence in the next instant.

Horzefalus Kwef managed to get a signal through: "Human ship *Harold Meeker*, land between the two westernmost missile emplacements at our base. Dive below us now; we will provide additional cover for you."

Deceleration compensators whined softly to themselves as the computer guided the *Harold Meeker* toward the designated landing site. The base was on the night side of Gilver. Not too far away, a large circle of ground was illuminated bright as day; at its center, the white tower that was the heart of the Great Unknown stabbed outward toward the stars.

Jennifer caught her breath at the beauty of the scene. She knew then that the esthetic sense of Odern's Foitani was different from her own, and also, she was suddenly sure, from that of their ancient ancestors. None of the pictures in their data base had been taken at night.

"Landing," the computer announced. "Recommend you do not leave the ship at the present time. The risk of radiation exposure outside appears significant."

"Did you program it for understatement?" Jennifer asked. Greenberg chuckled and shook his head.

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Having nothing else to do, they spent their first hour on Gilver making love. Just as they were hurrying toward the end, a missile made a ground hit close enough to shake the ship. Jennifer laughed softly.

"What is it?" Greenberg gasped above her.

"Stupid twentieth-century joke," she answered, clutching him to her: "Did the Earth—move for you, too?" Then, for a while that could never be long enough, all speech left her.

Afterwards, as he was dressing, Greenberg said, "Now I know you were really meant to be a scholar and not a trader."

"Why, Bernard?"

"Because who but a born scholar would come up with thousand-year-old jokes (and thousand-year-old stupid jokes—you were right) at a time like that?"

"I told you as much aboard the *Flying Festoon*. You didn't believe me then; I guess that's why you upgraded me from apprentice to journeyman."

"Partly I didn't believe you, I suppose. But there was more to it than that. You showed me you were a good trader. You got done what needed doing. You didn't seem to do it the way anybody else would, but it works for you, and that's the only thing that counts in the long run."

"I was using ancient literature as my data base instead of traders' manuals. No wonder things I tried looked strange to you."

"That's not all of what I meant, either," he said. "Most traders—just about all traders—push hard at everything they do. Pushing is part of being a trader. You're not like that. You're more reserved, shy almost. You were shy then—less so now, I think. But you still got a lot of business done."

"It's how I am," Jennifer said.

"I like how you are." His eyes softened as he smiled at her.

The communicator had developed a way of spoiling tender moments, almost as if it were a baby that resented anyone else's getting attention. It did not break the pattern now: "*Horzefalus Kwef* to human ship *Harold Meeker*. We have beaten the Rof Golani pirates away. You may emerge and join our scientic team."

"Then again, we may not," Jennifer said, irked at getting interrupted yet again.

The communicator was silent only a moment. Then the Foitan on the other end said, "Our weapons are trained on you. You will emerge and join our scientific team."

This time, the look Greenberg shot Jennifer was reproachful. She felt suitably reproached; she'd known since her first contact with the species that the Foitani were humorless. Greenberg said, "Thank you, *Horzefalus Kwef*. Let us put on suits, if you don't mind—the computer says it's 'hot' out there. Then we will emerge and join your scientific team." Sighing, he walked over to the airlock. Sighing even louder, Jennifer followed. ■

CONTINUED IN NEXT ISSUE

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Geoffrey A. Landis

STARSHIPS, ROBOTS, AND SPACE TRAVEL FOR THE NEXT MILLENIUM

Last April I had the excitement of being the technical chairman of an unusual two-day symposium at NASA Lewis Research center. Of course, at Lewis we're all quite proud of the work we do in the aeronautics and space programs, but there was a group of us who thought that there's more to research than just supporting the development of next-generation technology. We thought that NASA should look into further-out technologies—not just the next generation, but for the next millenium.

So we got together and planned a

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symposium, "Vision-21: Space Travel for the Next Millenium," for some of the other people who thought the same way, to see what happened. We invited some of the most exciting, free-thinking scientists and engineers we could think of.

The contributed papers were many and varied. One paper discussed the possibility of coupling to the space/time continuum for propulsion—a "reactionless drive." Another discussed faster-than-light propulsion. Tethers and nuclear rockets were featured, as were space-borne solutions to the greenhouse effect and the possibility of a large asteroid impacting Earth, and dozens of other ideas. Along with the invited speakers and the contributed papers, we had workshop sessions where the conference attendees could interact in a free discussion on topics of interest, such as methods of interstellar flight.

One of the advantages of being the chairman of a symposium like this was that I had the honor of serving as the moderator of a panel discussion with five of the most well-known speculative thinkers among the scientists and engineers of our time: Robert Forward, Marvin Minsky, Theodore Taylor, Paul MacCready, and Joel Sercel.

Physicist Robert Forward is not only a well-known science fiction writer, but also a scientist, a leading speculative thinker and an expert in advanced space propulsion technologies. His work for Hughes included development of new uses for solar sails, and pioneering studies of laser, microwave, and antimatter powered spacecraft. His recent non-fiction books include *Future Magic*, discussing speculative developments in technology; and *Mirror Matter*, discussing antimatter technology.

Marvin Minsky is known as one of the pioneering researchers in artificial intelligence. He is a member of both the National Academy of Science and the National Academy of Engineering, and recently won the Japan prize of 50 million yen for "establishment of artificial intelligence as a new discipline and the proposal of its fundamental principals." His most recent book is *The Society of Mind*.

Ted Taylor was the team leader for the "Orion" nuclear-bomb powered spaceship project in the early 1960s, a subject made famous by John McPhee's book, *The Curve of Binding Energy*. A former nuclear bomb designer who was involved with pioneering studies of nuclear terrorism, his current interest is in solar electric propulsion for space.

Paul MacCready is the premier proponent of human powered flight, an innovative aerodynamicist and aircraft designer whose designs include the prize-winning Gossamer Condor and Albatross human powered aircraft, solar powered vehicles like the Solar Challenger (solar powered airplane) and the GM SunRaycer, and innovative automobiles such as the electric-powered GM "Impact."

Joel Sercel is a scientist from the JPL Advanced Propulsion group, and a team leader for the "Odyssey" nuclear spaceship study. The JPL Advanced Propulsion group is involved in studies of innovative concepts for space propulsion, including such concepts as solar thermal and solar electric propulsion,

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nuclear fission and fusion, nuclear electric propulsion, beamed-energy systems, and antimatter propulsion.

This is what was said.

Landis: If chemical rockets are too expensive, and, as some have suggested, nuclear rocket propulsion is politically unfeasible, then what is the most likely propulsion choice for future manned travel in the Solar System?

Forward: I'd say solar electric, maybe solar thermal rockets. That is going to start limiting us as we get out further in the Solar System and get further away from the Sun. After that, why, there's sails and tethers. I would like to have both of those subjects not only explored in terms of building up our pile of paper stack of studies, but actually get some real operational experience in space. What we need more of is technology demonstration tests rather than complete scientific experiments.

Sercel: I would first question the assumption. The problem with nuclear propulsion is two-fold. First we have to identify the technical issues required to absolutely assure that it is safe, and then we have to take the story to the public and make a convincing argument that it's safe. If we lose one or both of those battles then we need to consider other options. Solar energy is probably the best other option. As Bob pointed out, studies in solar electric propulsion show that performance is comparable to solar sails. For operations in near-Earth space, beamed energy is also a possibility.

Landis: Ted, you are unique in being an expert in both nuclear and solar propulsion. What are your thoughts?

Taylor: It's likely that we can do everything we want to do out to the middle of the asteroid belt with solar electric rockets and possibly solar sails, and won't need nuclear energy for high performance. Beyond the asteroid belt there is some possibility of beaming energy by laser from close to the Sun, but the receiving end of this (if it's Saturn or even Jupiter) gets awfully big; just because of the diffraction limit.

What sounds good is to relegate nuclear propulsion to exploring the outer planets, and make all of that, without exception, done under international auspices. There is no reason to have nuclear power systems started up before they get way out there. As long as it's not threatening, because it is being done internationally, we could make full use of it.

Minsky: If there is some urgency, like a war, people operate with different criteria. If there is genuinely going to be a threatening asteroid that was going to do some huge devastation, all the countries would band together and rational choices would be made with fewer politics. However, to know that in six years something is going to come and zap you (I think that is beyond our forecast capability, but maybe we can convince somebody even if it turns out to be false) then we might be able to accomplish your mission.

Landis: What are the pros and cons of international cooperation versus international competition?''

Minsky: It's getting harder to cooperate because nobody keeps their prom-

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ises. It's no help for the United States to offer people launching space when we don't have any. I think Ted is right, if we can get efficient fabrication on the Moon, that should be the first priority, although maybe asteroids are easier. Then you only have to send up unstarted nuclear. You're sending up materials that haven't gone critical yet and they are pretty harmless (although it could be hard to convince some people of it). But, you know, if we wait about ten years it looks like everybody will start to go nuclear again despite themselves, just because of the fossil-fuel shortage.

Sercel: We looked at international cooperation when we studied the Odyssey concept. Technically, it appears that one could use nuclear electric propulsion to do pilot exploration of just about any interesting target in the Solar System this side of Saturn, with round trip times of something like five years. We took that analysis and said "What could we do with a space project that would challenge this nation well into the 21st century?" One thing that came up early in our look at it was the international aspects. I went back and did some historical reviews, and found that if you look through history, societies that have a high degree of contact with other societies have always been the ones that developed at the fastest rate. Presently, the world is smaller than it has been in the past, so there is always that kind of contact. But if you could design an international program that had the United States as sort of the center of it, with each of the partners contributing parts, then that would put us at the center of this network. That would potentially be very enhancing for technology development.

Landis: On the topic of speculative ideas, what methods do you use to get new ideas seriously considered?

Forward: The first thing to do is do a very serious study and get it published. But then you have a real long uphill battle of going around and getting people interested in it. If you keep talking to enough people, and enough *young* people, why, pretty soon the idea will get accepted.

But it takes years. Decades.

MacCready: Every case is a different case. You have to be lucky, and dogged, and the times have to be right. The big problem is that so much of the resources get linked into long-term giant programs. There aren't a lot of resources for getting started. Especially missing are discretionary funds the lab directors can allot to worthy causes. And when you've got to get into next fiscal year's budget, or the one after that, even to get started on the project, then things quiet down. So somehow diverting a significant amount, 5% or so of the budget, to high payoff and maybe low probability projects is very important, though very hard to do politically.

Minsky: When I was an assistant professor, one day a person from Exxon showed up and gave me this check for $10,000, which he said was for discretionary research. It was pretty thrilling and lasted four years, and ended up being worth about $300,000, because some student would want to do something and I'd say "Well, OK, what do

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you need?'' and he'd say ''I need this gadget, or that,'' so we'd get it, and then it almost always turned out that something useful came out of it, so I could charge it to the ARPA [Advanced Research Projects Agency] contract or something. But the leverage of small amounts, just trifling amounts, of money is huge—so you can get the materials, so the student can prove that it's feasible, and then the visitor comes and says ''OK, we want that''; ONR comes around and says ''Oh, we'd love you to include that under the real contract.'' Real contracts don't give you five minutes or five dollars to spend on ''crazy things,'' so somehow you have got to get that $10k from some philanthropist, just a bit of discretionary money outside of the contract so that the auditor doesn't see. If you wanted you could take it home, I suppose, but that's not the point.

MacCready: For certain topics a prize can be a good way to stimulate development. Somehow if you put up a prize of a certain amount of money, it harnesses work a hundred times that amount of money—or a thousand times. It provides a focus. I don't know if people are after the fame or the money or what, but suddenly a lot of people start working on it. It's hard to find just those challenges that you can have a prize with a good simple set of rules and the right criteria. That's not easy, but when you can then a prize is pretty good. You have to figure out somebody to put up the prize money, of course, but it's got some nice flavor and you only pay for winners.

Landis: Joel Sercel talked a lot earlier in the symposium about the potentials of self-replicating robots. What are your comments on what Joel said? Is this something that is likely to happen?

Minsky: There are some very critical things, it seems to me. If you make the kind of robot I was talking about, then you would make it out of exogenous materials. Maybe you can make all of the parts out of pieces of fused glass or metal—whatever you find on your asteroid or the Moon.

The problem in self-replication is usually that after a while you say ''Oh, I missed something.'' This robot is going to need a vidicon or a computer or a memory. For the foreseeable future you can make self-replicating systems that are pretty small and compact, but only if you send the seeds—the vitamins, as Sercel calls them—from Earth. A capable computer only weighs a hundred milligrams. What does a 68040 weigh? It's a few milligrams, it needs some electricity—you're going to need some magic way of getting power. I should think a good robot could make thermal bi-metal junctions, if it knew enough. But I don't see any easy way to make a transistor factory right now. It seems to me you could make most of the mechanical stuff in a robot. Maybe the vitamins include little motors. I don't know how hard it is to make motors, but it seems to me that if we are talking about self-replication, with a certain payload we could do tremendous things right now. You have to ship the inside of the joint and the little computer, and all that is only a kilogram.

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And then you make all the gross stuff. These robots, clumsy as they are, ought to be able to fabricate the other clumsy parts of robots, and that's a big leverage. Maybe if you send five or six of these to the Moon, and a hundred kilograms of chips and sensors, that's enough to make a big lunar factory —except for a few little critical things.

Sercel: When we were talking before I asked Marvin how long he thought it would take to make the first self-replicating machine. My guess was fifty years; Minsky said ten years, so I guess I am too conservative.

Minsky: Well, I don't want to stick to ten years, because when you are doing something ten years seems like a short time. I had this experience a couple of times in research. One of my really great students, Pat Winston, wrote a wonderful learning-machine program—learning structural descriptions by example. It's sort of a classic in artificial intelligence. And this was a little program that would learn to build little structures; a little house, or arch, or a tower out of children's building blocks and we all thought that was a great thing and we just looked forward to the next graduate student who would take it another step. It was ten years. I don't know why, but if you have a good idea you can't just order a student to work on it. That never worked, anyway. So, three or four years later another student understands the thing and starts to work on it.

Our Ph.D.s usually took about six or seven years because they liked it so much hanging around the lab. So, you could think of ten years in leisurely basic research as just the average time between each idea and the obvious next step. So when I said ten years, I don't think I really meant it. Fifty years might sound like a long time but it is just five steps of that sort. How many years between Newton and Feynman? About 300? And no one could say physics was crawling along in that time. It's a short time for major things, so who cares?

Taylor: There are pretty persuasive arguments that say that the gestation period of self-reproducing automata, once we learn how to make these things, is likely to be nine months, or a year. The litter size could easily be ten. What happens when that population explosion takes off, a hundred years later? There are likely to be other people out there somewhere who at some stage come across this and a hundred years later, out goes a paving and reshuffling and redoing enterprise that goes out more or less spherically at about half the speed of light, or maybe closer to the speed of light, and redoes everything in its way. That must have happened. Are we in the middle of it right here? Right now? Were we produced by self-reproducing automata?

Landis: That's partly an argument due to Frank Tipler. The point is that if there had ever been civilizations anywhere in the galaxy that sent out self-reproducing machines, they would have been here billions of years ago.

Sercel: You're not going to program a self-replicating machine to reproduce in an uncontrolled way if you're intelligent enough to make one in the first

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place. I would guess that if some civilization had made self-replicating machines, and a self-replicating machine came into our Solar System, it wouldn't necessarily start reproducing itself and take over the Solar System. It might be out there in the asteroid belt watching right now.

Landis: Since we've started on the subject of interstellar travel, the next question is: "Is the Orion [which is the atomic bomb powered space ship Ted Taylor worked on in the '50s and '60s], is the Orion concept still our best bet for an interstellar mission in the next 50 years?"

Taylor: The interstellar version of Orion came out of Freeman Dyson. We thought we were thinking pretty big with a space ship that would deliver a thousand-ton payload to Ganymede. We were pikers compared to what Freeman did. He had a space ship which was several kilometers across; the bottom of it was several kilometers across. And what made it go was around a million ten-megaton H-Bombs. It was to take something perhaps the weight of loop Chicago off to Alpha Centauri. It was a very big concept. I think he did that for the sake of completeness, to say "Well, what is the limit of this thing?" I mean, a million H-bombs are a lot, but not completely out of reason.

Interstellar travel seems to require a violation of some of the basic principles that we hold dear. To make something to connect back to Earth within lifetimes . . . the energy requirements are huge. When you look at those numbers and talk about sending something that weighs, say, 100 tons (which is awfully small for a voyage that long) up to, say, half of light-speed, the energy requirements are on the scale of all the energy that has been consumed by human activity from the beginning of time. Although we sometimes described it as an interstellar propulsion system, Orion never really was.

Sercel: It's worthwhile to point out that about every 30 years or so we double our energy consumption rate. In the process of that 30 years we expend as much energy as we have used in the entire previous history of man. So, if you do the back of the envelope calculation and assume that we continue to increase our energy consumption rate, it's only a matter of a few hundred years before we get to the point where a large interstellar mission is just a small fraction of global energy use. Maybe the easiest thing to do is just wait.

Forward: Orion is the only interstellar vehicle that we could have built ten years ago. If, for instance, we knew the Sun was going to go nova or the Earth was going to die or something like that, and we had sent some of our seed off, that's something we could have theoretically built, and built it a long time ago.

My effort over the last couple of decades has been to try to find some other way of going to the stars, other than using rockets. Now, many physicists have taken out the back of their envelopes and proved that you can never get to the stars using rockets in ten years, and they've done it and showed that you'd have to use up all the deuterium

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in the world's oceans as energy source and reaction mass; in order to send one interstellar vehicle to some star a hundred light-years away and bring it back. You can prove that, but that's wrong, because you make the wrong assumption!

One wrong assumption is that you are going to accelerate at one gee. You don't need to go at one gee. You just need to go at one gee for a year and then you are up to seven-tenths of the speed of light and coast the rest of the way.

Another thing is, you don't want to use rockets for interstellar flight in the first place. The rest of my effort in this field has been to try and find some method of moving through space other than using rockets. One of them is the Bussard ram-jet, which unfortunately Dana Andrews and other people have tried to make work and found we can't figure out how to make the hydrogen scoop yet.

Another is to use beamed power. I have written two papers on this. One of them is on a space vehicle, starwisp, that only weighs 20 grams—less than an ounce—and returns color TV pictures from Alpha Centauri. Those kind of things don't violate any physics, and they don't use up all of the world's supply of energy. In fact, all it needs is a solar power satellite to get it there and get the images back. So, you can go to the stars without violating physics and not using up the world's supply of energy, but it's not going to be easy, and it's not going to be fast. These things only get up to 20% of the speed of light, so the round-trip mission takes 25 years to Alpha Centauri. So you can talk about going to stars, and it's fun. But we still need better ideas and it is what I hope to inspire in some of you younger guys here.

MacCready: There's another way of looking at going to the stars. If you put a small amount of money into investigation with radio telescopes, IR and optical, that have diameters the order of the diameter of the Earth, or by locating things on the Moon and planets and so on, that you can get a huge amount of information about what's going on there. You are visiting them, but you are not visiting them by going there and bringing something back. You are visiting them by really looking at every bit of radiation that comes out.

Forward: Interstellar travel by SETI? My last novel was deliberately written to include an alien life form that would never have radio, and yet was very important to find because he had much more intelligence and had developed mathematics much further than we had. I deliberately did that because there are people like Barney Oliver and Sagan that say that the only way to do this exploration is by listening by radio and anybody that talks about flying to the stars is right off the back of the cracker box.

Taylor: I have to say that if the natives out there are friendly and have an urge to get up close to us, they'll come and get us.

Forward: But not if they don't have technology. For example: do you think the whales will develop technology?

Taylor: Whoever is out there, if there is anybody out there, the chances of

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their being only 100 years from the invention of radio, and such, are infinitesimal. They are either amoebic, or monkeys, or way ahead of us; not right where we are.

Landis: I've always wondered why the SETI people keep focusing on radio. Obviously an intelligent life form would use the shortest wavelength possible to communicate over interstellar distances. So, perhaps we won't find out anything until we get the gamma ray telescope up.

Forward: Or neutrinos?

Sercel: Maybe we can travel by information, as opposed to physically traveling. If they've already built self-replicating machines that are waiting on the asteroids for us, then all we have to do is get in contact with one of them, and they can send the information required to make a human being back to their home world.

Landis: So perhaps they are just waiting for us to develop the receivers that can download their life forms.

Sercel: I am told that there is already some evidence of planetary systems around other stars. For example, images of the star Beta Pictoris suggest some kind of planetary system, as well as some of the infrared data that came back from IRAS. And that hasn't resulted in a revolution in our space program.

Landis: The IR signature really comes from pretty small particles. It's mostly dust that they're talking about.

Sercel: But it is suggestive of the first stages of accretion of planetary systems.

Forward: Once we actually design a telescope that has the right kind of occulting disk to block out the major star and is well designed so the light leaking by doesn't louse it up . . . once we get a picture of a green planet, a lot of people will be very intrigued, I think, and interested in going there and that would be fun.

Landis: One of Bob Forward's papers suggested it should be possible within the next many decades to make a lens 1,000 kilometers across or larger. O'Meara's intent in designing this giant lens was that with this giant lens you could not only detect Earth-like planets out to hundreds of light-years, but you could map them with 100 kilometer resolution.* So that if the planets are out there and we have the technology to get there via these laser propelled ships, we'll know where we're going long before we go.

MacCready: Looking at the practical side, such projects are going to have to be government funded. The government is run by people interested in what happens during their term. And although a few far-sighted things sneak through it is going to be very hard to do something where the results are going to come in 30 years later, or 200 years later, with our political system.

Forward: In my very first paper on interstellar flight, I pointed out that even if you could travel at the speed of light it would take you 4.3 years to get to

*See my paper on laser sails, paper IAA-89-664, presented at the 40th International Astronautics Federation Congress in 1989. Since the symposium I've had a chance to read Robert Forward's novel *Rocheworld* (first serialized in *Analog* under the title *Flight of the Dragonfly*), where he also discussed the possibility of using a giant thin-film lens as a telescope.

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Alpha Centauri, and either 4.3 years to come back, or for the information to come back if you decided to stay there. And that is 8.6 years, a half year more than the term of a president. So no interstellar mission will every fly.

MacCready: Whereas if you have this super telescope you get the information right now.

Landis: What do you think the likelihood is of AI machine civilizations elsewhere in the galaxy? What do you think is the likelihood that we might evolve into a machine civilization ourselves?

Minsky: That's sort of Gregory Benford's field these days, and David Brin's. It seems to me fairly likely that in a thousand years or so, or less, we'll turn into one. I just can't imagine a people as smart as us tolerating disease and senescence and all that sort of thing once the option becomes available. There's Hans Morovic's script for that in *Mind Children*. Some people will say, "No, I don't want to be machines" and they will have their choice and die out. There is this singularity in evolution and when we understand how to make ourselves into better hardware, then some people will do it and some won't and that will be that.

Sercel: The one thing I wonder about is whether you go green or go gray. The metallic approach or genetic engineer.

Minsky: I guess green is cheaper.

Forward: I usually say we already *do* turn our world over to little bitsy robots. And we do it because we trained them, brought them up to be human beings and believe in our culture and we trust them, finally, enough to go and retire and turn the world over to them. I don't see any difference between that and the act of training some kind of silicon little being and doing the same thing.

People argue, "but they're not made of meat." Of course they don't exactly say that, but that's really what we are trying to do: run a world with computers made of meat. And there are better ways of building intelligent beings.

Landis: Downloading ourselves into machines will make the interstellar travel problem much easier because the time frames don't really matter. If it takes a thousand years to get to Alpha Centauri at a small fraction of the speed of light, that's OK, because you turn yourself off and turn yourself back on when you get there.

Forward: I think one of the whole points about interstellar travel is that if it takes you more than fifty years to get there and you haven't completely eliminated all the other methods of propulsion, then by the time you're halfway there, somebody is going to pass you up. You don't want to build a spacecraft unless it can get there in less than 50 years. At least not until we have run out of options on propulsion technology—we are a long way from that.

Landis: That's OK, it's just a different copy of you that's passing you up. So you just download your new copy onto the old one as you go by.

Sercel: With regard to machine civilization, one might observe that the transformation between biological civilization and machine civilization is not a distinct one, but a gradual process.

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And it's a process that's already started. We use automobiles for our legs, and we use tractors for our arms, and, in fact, considering the impact we are having on the biosphere (which is purely biological), it may be that machine civilizations and biological are not compatible and it may be the most natural place for a machine civilization to live is out in space, where it is not interfering or destroying a pristine, delicately balanced biological environment.

Landis: Let me ask this one last question. Should the Solar Power Satellite be used as a focal point for long-range international space efforts? And, if so, what should we be doing right now?

Sercel: The Space Solar Power Satellite is a very interesting concept. It has some problems and it has some strengths. Right now we don't know enough about the technology options to really know whether it can be made cost effective and safe. If those studies conclude that it can be, then it would be a very interesting thing to pursue, but we don't have enough information to make that decision now.

Forward: I'd rather see that we focus on some other goal. That particular choice isn't so obviously effective. We just really don't know. It has some very good points, but it's not so obvious as "Let's go to the Moon" or "let's go to Mars." Those are things that aren't really trying to make a profit. You're just doing it for the heck of it.

Taylor: Before using solar energy collected in orbit will look in any sense economical for producing electric power, it will have first happened on the Earth's surface. If you want to see a candidate for a near-term revolution in energy production on the surface, a clear front runner is hydrogen produced by low-cost photovoltaic cells and then used as an all-purpose fuel. There's a lot of attraction for a hydrogen economy. We can do it on Earth. In fact, we are right on the verge of being able to do it this decade at costs that will compete with natural gas. I don't see what need the Space Power Satellite meets that we can't do cheaper, better, quicker on Earth.

Minsky: I have one concern. I wonder which projects we ought to do as soon as possible because rising population and the fusion of interest in world governments will come to the point where nobody dares do anything. There is a fear that in another twenty years a curtain will come down on all forms of exploration, and everybody will be too careful to launch anything. ■

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A healer with an alien patient is sure to have plenty of problems. But facing one may be the key to solving another
Dell Harris
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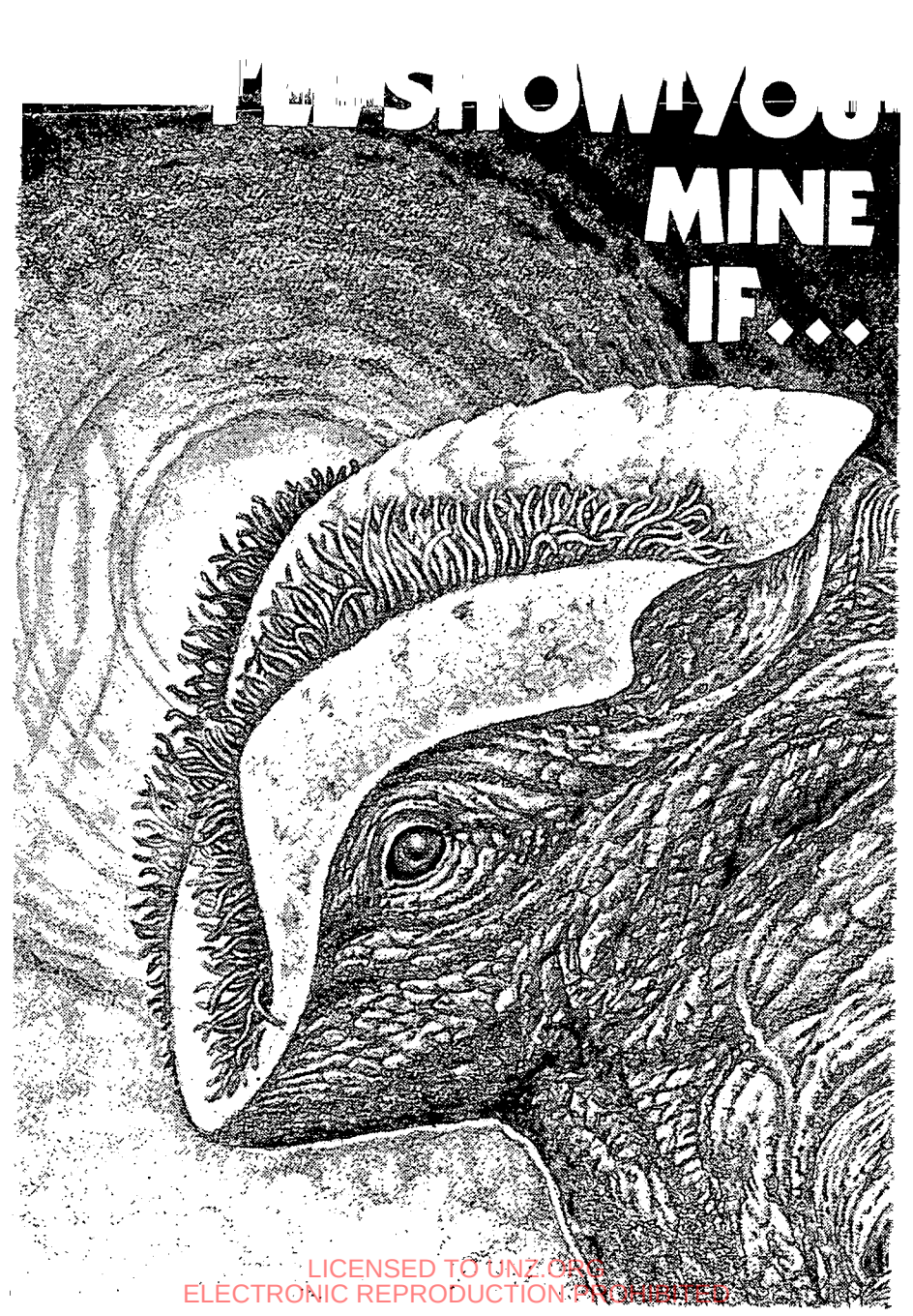

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Mianne's thermal pattern was clear even if she was ignoring him. The slight flare of heat on her hind-leg, where she had hurt herself last Cycle, and the crooked sensor row on her head were unmistakable. Tuane approached carefully.

Mianne pulled away. "I am not available." She spoke verbally! And the accompanying feeling was unmistakable. She wanted nothing to do with him.

[*Why?*]

[*You lost status.*] *Mianne was kinder and projected back.*

[*But we were to be mated!*]

Her body shivered briefly in 'sympathy.' [My village will not accept you now. I can not . . .]

Rejection. That was something Anna could understand as she pulled back from the vividly bizarre images and sensations that surrounded her.

She pulled off the suffocating helmet and glared at the alien figure standing still in the other room.

Across the table from her, Jimmy pulled off his matching monitor-helmet and brushed out his long, snow-white hair with his fingers. "You OK?" His wrinkled face was tight with concern. "Something was bugging you. You're not having any problems with the helmet that I'm not picking up are you?"

"No, I'm fine. Tuane was just remembering an old girlfriend, and getting rejected by her. I can't seem to get past that. After the third replay, it was getting to me."

"Why?"

"Why? It hit a little close to home, that's why. Look at me! How many guys do you think go looking for an overweight, frizzy-haired psychiatrist for a long-term girlfriend? They're either afraid of getting analyzed or just want someone better looking—or both. Usually both."

"You're pretty enough, Anna. And you—"

"You're sweet, Jimmy." She leaned forward and kissed him on the cheek. "Thanks, but I know where I stand. And it's OK. I'm used to it. Besides, don't make Betty jealous."

"After forty years, she knows me better. I'm hooked." He sighed, but he was fingering the locket around his neck lovingly at the same time. It held a picture of his wife that he had proudly showed her.

Anna turned back to the high window wall beside her. She didn't see Tuane this time. Instead, her eyes focused on the reflection of the room behind her.

A full-height Plasteel barrier had been installed between two luxury suites of the Geneva Ritz-Columbard Hotel, and the contrast between the rooms still amazed her. Her side could have been a sitting room in an eighteenth-century palace. Plush, brocaded carpets covered the floor—red in the bedroom and russet in the sitting room. Ornate furniture under a painted ceiling and crystal chandeliers completed the illusion.

But the converted suite beyond the Plasteel wall looked like a set from a science fiction movie. Gleaming metal fittings and smooth, streamlined, but mysterious alien furnishings reflected the soft, reddish light that seemed to emanate from the walls and ceiling.

The impression of a stage setting was

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heightened by the room's motionless alien occupant. Only two of the Centaur ambassador's eyes were visible and there was no way to tell if they were watching her. The three blank and featureless obsidian eyes gave nothing away. She wondered if he had even noticed she was no longer in his mind.

"Why aren't you cooperating, Tuane?" She leaned closer. "Do you even know I'm out here, or are you just being stubborn?"

Jimmy swallowed and looked uncomfortable. "You know, this is the first time I've really been close to one of them. Paul contracted me to adapt these helmets for human use when they showed up here on Earth after the initial contact on Agra, but I never saw more than holos or anatomic and neurophysiological charts. I'm sorry, they give me the creeps."

"Well, whatever you feel personally, you've worked wonders with these damned useless helmets . . . I'm sorry. They're neither. They just need a little more finesse. I'm glad we're not in his chamber, though. That whole room is a large probe-helmet. That scares me. I keep thinking how it could be misused."

"Relax, the human brain is so weak, signal wise, that even with this helmet, we can barely use its output." Jimmy smiled and reached across to pat her hand. "Besides, I'm the only one who understands it reasonably well. And I only know about the exposed parts of the system. The unit here, and the circuitry wired into the walls of Tuane's suite, are only satellite devices. The computer that handles the processing of the probe-sensors' information is on board the Centaur ship. No human has ever had access to it."

"OK. I won't worry about it." She smiled and laid her own hand on his leatherlike one. "Thanks."

Then she heard the door to the hall open behind her and turned to see the Paul Gordon enter, his steps echoing on the gleaming parquet floor in the foyer. The young UN administrator looked curious.

"You aborted. Why?"

"Why not?" She shrugged, wondering how he knew. "I can't do anything here."

"I take it he isn't responding?"

Anna shook her head, explaining what had happened. Then, as Gordon turned to Jimmy, she got up from the intricate probe controls to stretch, reaching for the high, frescoed ceiling. After a sour look at the dividing window-wall, she glanced over at where Gordon was talking quietly with Jimmy.

"I understand he won't even talk to his own people," Anna said.

"It's their social structure," Gordon explained. "You ought to recognize it since you worked in the Orient for a while. That's one reason I picked you. The Centaurs are very similar in terms of 'face.' Preserving 'status' is paramount in their society—"

"I know. It was a rhetorical question. That's why he'll let us do a mind-probe, but he won't come out of there even if ordered: because he hasn't finished his job and he'd lose face—status—by giving up."

She turned her chair carefully and sat back down, facing away from the Centaur. "Why won't his people on the ship come get him and replace him?"

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Jimmy shrugged while Gordon took a guess. "Maybe because if they do, they can't finish their mission and finalize the treaty? Tuane is the empowered ambassador for the ceremony. If he can't do his job, the Centaurs have to send out a whole new team."

"And Tuane's not acting rationally." Anna twisted and glanced at him. "I wonder what could have overwhelmed him so much that he won't come out of his hotel room? He didn't have any problems when he first arrived. I saw the pictures. He was wearing his atmosphere-suit like a second skin, obviously used to it. The gravity difference might have been unsettling, but surely no more than stepping onto the Moon or Mars was for our own astronauts? It was a lot worse for our teams on the Centaurs's world." She sighed. "I just wish he'd talk to me. That's the real gasper."

"That's why we called you, Dr. Mackey. Hope—"

"Why was I the only psychiatrist who would do? When your people called, it was pretty clear they were determined to get me to sign on to your team. I asked for triple my usual consulting fee, as a joke, but nobody batted an eye. I got it."

"I wanted someone experienced with Orientals because of the cultural similarities. And I wanted a woman because, among the Centaurs, only females work as doctors of any kind—and yes, they can tell our genders. They've been studying us for quite a while. They've been waiting for us to develop sufficiently to be able to tolerate contact. But I wanted a woman to be consistent with their culture. So you were the most convenient person for us. No one really knows much about the insides of the Centaur psyche, so don't worry about feeling unprepared to handle this. Everyone is!"

"I know. I'm sorry to be a bitch, but it's been a bad day. If it wasn't for Jimmy's moral support, I'd be a total mess." She smiled fondly at the older specialist. "I just can't get a handle on why Tuane refuses to come out of that room. All he keeps thinking about is an old girlfriend who crashed him." Gordon's brown eyes opened wide and Anna couldn't help smiling. "What's wrong? Why shouldn't they have the same problems we do? They're a lot like us. Bisexual, family oriented, and so on. Other than the fact that their world would kill us, we're pretty similar."

Gordon looked embarrassed. "I guess it just hadn't quite registered."

Jimmy spoke up after a moment's silence. "Do you think . . ." his eyes flashed towards the Centaur briefly. "Do you think he's sulking?"

Gordon and Anna both looked over at Jimmy. A helpless smile lit Gordon's face and strangely enough, he was terribly appealing suddenly—now that he wasn't 'in control' but as much at a loss as she was. She decided it was because he wasn't afraid to admit it.

Anna felt a sudden surge of curiosity about the UN Diplomatic Corps Director. Unlike most men her age, when he had seen her for the first time, he had welcomed her as openly and genuinely as if she had been a lifelong friend. So had Jimmy, of course, but with him there had never been anything but a meeting of professionals involved.

She brought her mind back to Jimmy's

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question and shook her head. "I doubt he's still sulking. The rejection happened much earlier. He never would have come on this mission if it had been that simple. I wouldn't be surprised if he took the mission to try to show off, to regain status. I caught a flash of shame with the memories of the rejection. He lost status somehow. That's why his girlfriend rejected him. My guess is that something happened here that relates to that." She turned to Gordon. "I want a record of everything he did before he went into that room. Can you get me a hard copy of his itinerary?"

"Sure." He came over to the terminal beside her and leaned down to speak to it briefly. His eyes met hers for a second and then danced away. His lips curled up softly and for a moment, he looked like a happy little boy.

She felt herself smiling back automatically. He really was quite attractive, she decided. His sandy hair was just disarrayed enough to give him a relaxed look to counter his immaculately pressed grey suit.

Almost immediately, the terminal's feed-slot spewed a number of printed pages that he handed over. "The access codes for the video recordings are on the last page."

Was it her imagination, or did his hands linger on hers just a little longer than necessary as he handed her the printout?

"Thanks." She felt suddenly shy and dropped her eyes. Angry at herself for behaving like a school girl, she looked back up at him. "Now, could you please leave us alone again?"

For a moment he looked mildly hurt. Then he backed off and gave her an amiable wave as he slipped out the door. "Call me if you need anything."

"You like him, don't you?" Jimmy asked as the door slid shut.

She nodded absently as she looked through the window at the Centaur. "Is he married?"

"Tuane? I thought you said he had a fight with his girl friend?" He was grinning. "Sorry, I couldn't resist that. Paul? No, and he's not seeing anyone either. At least not as far as the underground bulletin board goes, and we have a real good one. He's good people. Just relax and do your job and see what happens. He hates quitters and incompetents more than anything. Failure doesn't bother him, but failure to give something your best try does. He's bound and determined to see humanity carry out this meeting with dignity."

She laughed. "Thank you, Dear Abby. And with that subtle reminder, let's get back to work."

She turned back to the Centaur. At least she didn't have to worry about what she looked like to him. To the Centaurs, all humans were probably equally bizarre. Just as Tuane looked outrageous to her.

Centaur.

The word conjured up images of the mythical half-man, half-horse, and at first glance the name seemed ridiculous. But after looking at him for a little while it was easy to understand how the Agra colonists, who had first been contacted by the Centaurs, had hit on the name.

The aliens were quadrupedal and about the height of a fair-sized Shetland pony. In front, coming out from the lower chest between the fore-limbs,

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were two muscular arms tipped with clumsy-looking hands with only three fingers. In the middle of the chest was a large, startlingly human-looking mouth equipped with a herbivore's grinding teeth. A short stubby neck with flap-covered lung-openings took the place of the mythical human torso. It was topped by a small football-shaped head that had three ebony eyes ringing it at jaw level. There was no sign of a nose or ears, but she knew from her briefing that the crossed sets of fringes on top of the head acted as nose and ears by sensing sound as air movement and sampling molecules of air. In the dense air of the Centaur's heavy-gravity world—almost double Earth's—it made sense. The small head was no surprise either. The brain was located in the middle of the body and the head only served to house the sensory organs.

All in all, the body was a masterpiece of design that would overcome the barriers of crushing gravity and dense atmosphere.

She had to find out why he wouldn't come out on a world that was perfectly safe.

"Tuane, dear, what *is* your problem?" She propped her elbows on the table, folded her hands and rested her chin on them. "Are you staring at me? Or can't you see me through the glass since you see with infrared?"

She looked down at the itinerary. Did it hold the answer? She sighed and rearranged her heavy, carved chair in front of the small table that stood up against the window to Tuane's chamber. The folding metal military issue table looked totally out of place among the hotel room's other furnishings. She spread out the pages of the report on the table. "Sorry, Jimmy, but I want to go over this before I link with Tuane again."

Was it her imagination, or did Tuane's head tilt slightly to follow her movement?

She ignored it and started looking through the printout.

Some time later, chafing again under the oppressive helmet, Anna focused her thoughts to call, [*Tuane.*]

She tried again. Tour scenes. She replayed in her mind the places where Tuane had been taken by the welcoming committee, picturing them in her mind as she tried to reach Tuane.

[*You landed in Arizona,*] she began, [*then they took you to see the Grand Canyon and the Rocky Mountains?*] Nothing. [*Then, moving west, they took you over Japan, the United Chinas, the Independent Soviet Republics and the Independent Baltic Republics, and the European Commonwealth?*] She felt a dead stillness suddenly.

She was totally blocked. Somewhere along the way, she had lost the Centaur. And for some reason, she felt uneasy.

An impenetrable barrier had gone up between Tuane and her. Because of something on the European leg of the tour?

Europe . . . the Eiffel-2 tower . . . unwanted memories flooded her as she remembered a summer during medical school when she just had to escape and had taken a trip to Paris. It had been right after she had been dumped by another student she had been seeing. Old memories of her own welled up again, amplified by the probe-helmet she wore. . . .

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"The Eiffel-2 Tower, ladies and gentlemen. The tallest structure in the world. Made possible only through nanotechnology. Its structural members are the strongest in the world. The building serves no practical purpose, of course." The guide laughed an overly practiced chuckle as if admitting a reluctant secret. "But as a tourist attraction, I think you'll agree, it's second to none. You are among the first people to set foot up here, other than construction robot supervisors, because it is not yet completely finished. The Tower's only being opened to the public this weekend because it is the anniversary of the original Eiffel tower's completion."

The guide paused, took a deep breath, and went on tirelessly, mechanically. "The construction of this tower was made possible solely by private contributions from millions of outraged French people who mourned the destruction of the original tower by terrorists. Even if it was unsafe by then, it was still a national monument . . ."

The speech bored her, and Anna's mind wandered as she looked out over the distance. And then, nervously down. At this height, Paris was a homogeneous collage of delicate color shadings. No details could be made out. Notre Dame was a slightly larger speck of dark grey and the Seine a slender thread winding across the landscape.

The way the observation deck was designed, she seemed to be almost standing in midair . . . way up in midair!

She turned away and grabbed for the reassuring solidity of a decorative pillar. Her head was swimming and her stomach was more than a little unsettled . . .

A chink in the barrier!

Tuane's shield cracked briefly, and for a moment she had a glimpse of jumbled impressions before the mental wall slammed shut again. Apparently his shield didn't keep him from scanning her mind while she wore the helmet.

She filed that potentially useful detail as she wondered what had made him open up briefly. The tower? She fought down a surge of undefined panic. Why had she remembered that all of a sudden?

She pulled off the helmet to confront Jimmy's concerned face.

"Something happened there—to both of you. Something scared you in that memory, and you got a reaction from Tuane. What was it?"

"Nothing!"

"Hey, relax." He took her hands gently. "I'm on your side."

"I'm sorry. I don't remember."

"Well, the helmet seems to help. Put it on and try again. Tuane was definitely reacting."

She put it on reluctantly and thought back . . .

She couldn't remember much of the trip, actually. What had happened there that had triggered sudden unease, and a reaction from Tuane? She had just toured the tower and then . . .

The sound of the elevator door

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hissing shut startled her. She turned in shock. The tour group had vanished and left her standing alone in the observation tower. She had been concealed behind the pillar when the dizzying view below had upset her. The guide hadn't seen her standing there and had herded the others off, assuming she was with them. No big deal. She would just have to wait till the next tour group came up, since the elevator was ID-coded. Granted, this had been the last day-tour, but she thought she remembered reading about an evening tour in a few hours. The nighttime view was supposed to be breathtaking.

Suddenly she felt a guilty thrill. She was up here against the rules and had the whole tower to herself. Neither the gift shop nor the restaurant were open yet.

But the latter was on the floors below her. She visualized the top of the tower from the publicity-holos she had seen, trying to think how she could get to the other floors.

The top of the tower housed four levels. Uppermost was the circular observation deck surrounding what would be a gift shop. Then, on the middle two levels, the beginnings of what would be an exclusive restaurant accessible only by its own private elevator. And below it, the kitchen and storage areas. The restaurant would be too expensive for her to be able to afford for a long time and she wanted to be able to say she had been there before they even opened.

Somewhere there had to be an uncoded elevator or maybe even some stairs.

She looked around curiously until she spied a promising opening. She entered guiltily and found herself in a small closet instead of a stairway. Sighing, she turned to go back out to the hall.

The door wouldn't open. In the pitch-blackness of the tiny room, she was unable to find anything like a door patch. She groped clumsily along the smooth inside of the door and the walls surrounding it.

At first she was fine. But the blackness grew denser and denser as she continued to scrabble, looking for a way to open the damn door.

Was there an air opening?

The air seemed to be getting a bit foul-smelling, she thought. And it was getting hot! Where was the gasping control-pad? . . .

Her world went black momentarily and she felt herself pulled free. Daylight flooded her eyes and she looked up to see Jimmy looking down at her, his face pale.

"Come on girl, snap to it!"

Her hands were shivering, and she clenched them into fists to stop the betraying tremor. "I'm OK. Thanks!"

Jimmy shook himself and let out an explosion of air. "Whuff! No wonder you didn't want to remember! Are you sure you're all right?"

She nodded. "I think so—"

She was interrupted by the hiss of the door opening as Gordon came in, slightly out of breath. "Are you OK? I got a call that the Centaurs were monitoring a stress situation."

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"I'm fine." But she knew she didn't sound it.

He moved closer and his face was concerned as he took her hand. "I don't believe it."

"OK, so I'm a little shaken up." She explained about the flood of memories from her Paris trip, and of getting trapped in the closet. " . . . I had forgotten all about that closet. I was trapped there for over twenty hours until the construction crews returned on Monday morning. I almost died in there. It hadn't been hooked up to power or the air-conditioning system yet. The evening tour had been canceled because of an elevator malfunction, and no one heard me screaming for help. It was pretty bad."

She swallowed a couple of times. "Anyway, ever since, I've had a problem with tight spaces. It's stupid because I know phobias are the most easily treated psychological disorders. Not that I really have a phobia," she added quickly. But her hands were still trembling.

Then she realized that the Centaur was staring at her. For the first time since she had seen Tuane, he had moved. He was closer to the clear panel separating their chambers, and there was no mistaking the vigilant angle of the tiny head and the way it swiveled, giving each eye a chance to inspect her.

Her panic had definitely gotten his attention.

Could his problem also be a phobic reaction of some sort? Could it be that simple? *Not that I'm really phobic*, she told herself again. *I just don't like closed spaces.*

She freed her hand and watched the Centaur carefully as she bent and reached for the probe-helmet. Tuane moved back a couple of steps, in a graceful, dancing motion.

She looked at Gordon and Jimmy triumphantly. "He reacted to my panic back there, and now, when he thinks I'm getting ready to contact him again—" For a minute, she was silent. "I'm going to try something. He's reacting to my panic attack."

"So what are you going to do?" Gordon asked.

"I'm going to check for some particular phobic reactions."

"Do you really think that's wise? What if you make things wor—" She cocked an eyebrow in silent response and he cut himself off. "No, I guess not. Well, use your own discretion, but be careful!"

"You'll back me?"

Gordon studied her for a moment and then nodded resolutely. "Dr. Mackey . . . may I call you Anna?" She nodded. "Thank you, Anna—and call me Paul. I've studied your file extensively—along with those of the other candidates, of course—and I picked you because . . . of a hunch. And that's why I'll back you."

Anna leaned back and tried to keep a serious look on her face. He was obviously having a hard time with this.

"You see, I've gotten to where I am by playing hunches. Hunches about people, and situations. I'm almost never wrong." He turned to Jimmy with a mock-threatening expression. "Don't you say a word or I'll tell Betty what happened on her birthday."

"OK, Boss!" Jimmy grinned.

Paul reminded Anna of a little kid

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again. There was something so open and "real" about him.

He faked a hurt look. "Don't look at me like that. My hunching got me through college and grad school by letting me pick compatible teachers. Then it saw me through the diplomatic corps until now, I basically run the entire Contact Program. And I'm not even forty yet. I'm good with people, and my feeling told me you were right for the job."

She started to crack a joke, wondering about the implied failure he had warned Jimmy about, but she stopped. He was serious. And she had to admit, from what she had heard, that he seemed to have an uncanny ability to handle people and situations. Still she couldn't resist asking, "And has your hunching ability found you a girlfriend?"

His face turned red. "I haven't really had time yet. Look, I've got to get back to my office. But, like I said, I trust you. Do your thing, and let me know what happens." He shook her hand briskly and disappeared without another word.

Anna realized Jimmy was grinning. "I think he likes you."

"Nonsense! We don't have time for that. Now be quiet while I think. I have to decide how to test if what I'm dealing with actually is a phobia. Then I have to figure out what the phobic situation is. Like I told Paul, I think I have an idea."

She looked at Tuane. "I wish I could go in and actually stand next to him. I'm not sure why. I just feel too removed from him here on the other side of this barrier."

"That's why there's the helmet."

Jimmy was right. She would have to use it. She also admitted to herself that she hated the helmet because in its own way it, too, stuck her in a confining dark space.

She took a deep breath and slipped on the helmet.

[*Tuane!*] she projected. [*Answer me!*] This time she made it an order, not a request. [*I'm your doctor, damn it, and you're going to help me help you whether you want to or not.*]

[*Yes, Healer*], a clear crisp thought responded.

She was startled by the automatic compliance until she considered the situation. He was ill. He was certainly intelligent enough to know that. As a doctor, "healer" to him, she was in authority over him with regard to his condition, and he was bound to obey.

Social structure and propriety. She chided herself for not thinking it through before.

[*When I was first in your mind, you were remembering being rejected by a female of your species. Why were you rejected?*] She felt Tuane start to block her out again, but this time she stopped him with a sharp command to answer her.

After a moment she felt him respond. [*I lost status—*]

[*Why?*]

[*I became afraid when on a survey trip. There was a mountain overlooking a prime site for a generating station and I was supposed to make some measurements. Instead, I panicked and lost control—*]

[*Show me.*]

She found herself swallowed up by an incredibly vivid memory. . . .

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He was standing at the top of a low cliff above a cracked and jumbled plain where steam fumaroles spouted periodically. Overhead, a murky sky shifted sluggishly, brown and orange swirling in sharply striated patterns of color. Behind him, his crawler idled while he took the final measurements of the cliff top. This was where they would put the administrative offices, and he wanted to be sure that there was enough room for the pre-fab modules. The steam-field had already been surveyed and another team was coming in next-light to lay down the piping guides for the geothermal powerfield.

There, he was almost done. All that was left was to check the clearance to the edge of the cliff. Starting to feel uneasy, he stepped closer to the edge and looked down. Surging panic overwhelmed him until the world spun and faded . . .

She broke free and pulled off her helmet, starting to understand what was going on.

"Why the panic?" Jimmy wondered. "He was freaking out for no reason. It was just a low cliff."

"Remember who you're dealing with. That 'low cliff' you're shrugging off was a good ten meters high—on a world with double Earth's gravity. And he was right at the edge. Cliffs and mountains—where there are any—are avoided where he comes from. I'm not surprised Tuane 'freaked out,' as you put it. That's not the reason for his phobia, though."

"No?"

"No, it's just one instance where it caused problems. Sometime earlier in his life, he was probably scared real badly in a similar situation, and that's what makes him phobic now. The Centaurs share a lot of psychological traits with humans and I wouldn't be surprised if, just like with us, certain phobias are more easily acquired than—"

"You mean like it's easy to get a phobia about an animal, but not about chairs?"

"Exactly. Biologically, it makes sense to more readily develop some fears than others. A whole evolutionary history has preprogrammed it. As for the Centaurs, considering the very real danger of heights, a phobic fear of them would be easily acquired. And it gives me a preliminary diagnosis. He's acrophobic—afraid of heights. Which makes sense, since he first reacted to my memories of being up high in the Eiffel-2 Tower. I'll have to access my DSM-10 for the specific classification—at least in human equivalent terms. That's the Diagnostic and Statistical Manual for Mental Disorders." In her mind she was already tracing it from "Anxiety Disorders," to "Phobic Disorders" to "Simple Phobias"—*which includes claustrophobia*, a tiny voice in her mind nagged. "I can't believe how stupid the planning of his tour was, though."

"In what way?" Jimmy asked.

"Well, think about it. He's terrified of heights, and what do they do—"

"They bring him thousands of feet up in the air on a clear day and take him from the Grand Canyon and the Rocky Mountains to Mt. Fuji, the Himalayas, and so on." Jimmy shook his head and grimaced. "Whew! You're right. They must have scared the living shit out of him!"

On impulse, Anna scanned the visual

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records of the tour once more. This time she ignored the locations and tried to catch glimpses of Tuane whenever he was in camera range. Sure enough, he was increasingly stiff and unresponsive as the tour progressed. By the time he had been delivered to the hotel here in Geneva, he had been virtually catatonic.

She showed Jimmy. "That's what happened all right. But that means I've got to replan my treatment strategy. Since I wanted to treat him quickly, I had intended to try flooding as his treatment since phobias usually respond well to that." It was Jimmy's turn to be confused and she explained. "Flooding uses planned massive exposure to the phobic object or situation. But the whole tour was an unintentional flooding experience, only lacking the direction and regulation that might have made it effective."

It did explain why Tuane had been thinking about the time when he had been dumped. Again, he had panicked when exposed to heights and open spaces, disappointing those in authority who expected him to do a job.

"So now what?" Jimmy wondered.

"I'm not sure yet. Give me a minute." How *would* she treat Tuane now? She giggled at the mental image of greying and bearded Freudian psychotherapists trying to unlock the childhood sexual frustrations of a thousand-kilo alien who was sprawled upside down on a sagging leather couch, all four elephantlike feet flailing helplessly in the air.

Seeing Jimmy's look of concern, she got control of herself. There wasn't time for psychoanalysis or cognitive therapy—not that that was terribly effective with phobias, anyway. No, flooding was the only quick, effective means of dealing with them.

She noticed Tuane studying her and had the feeling he wanted to talk to her. She realized that she was starting to be able to analyze his postures. She had probably been getting subconscious feedback from him whenever they were linked.

"Better hook in, Jimmy. I think he wants to talk to me."

[*Who is your Healer?*] Tuane's question was immediate as soon as she was engaged.

She froze. *Her* healer? Then she remembered how Tuane had been linked with her when she had remembered being trapped in the Tower storeroom. Suddenly her thoughts raced as she quickly snatched off the helmet with clammy hands.

An idea had unfolded as she absorbed Tuane's question. Would it work? Could she do it? She felt her mouth dry up and a tightness forming in her chest.

"Hey, what's wrong, Anna?"

"I'm claustrophobic," she admitted reluctantly. "How can I be convincing trying to treat Tuane when I haven't even taken care of my own problem?" She chewed on her lower lip a moment. "I have a problem and my patient has a problem. Opposite, but the same. If I can handle mine, while he watches, maybe he'll understand and we can deal with his together? It makes sense. The Centaurs are extremely logical beings, and if I can demonstrate my ability to help myself, half my battle will be won."

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Jimmy looked worried, but he saw that she had made up her mind.

She placed the helmet back on her head. As the enclosing device shut out the world, she felt her chest tighten and her pulse elevating. She realized that she had been denying the extent of her problems the whole time since that incident in the Tower. She would have to be careful. Tuane was with her now . . .

She pointedly ignored Tuane. The Centaurs were "human" enough that that ought to get his attention. She was doing this for herself.

First, to what extent am I claustrophobic? she asked herself clearly.

She pondered the question, thinking of herself as a new patient. What symptoms did she have? Aside from her reactions to confined spaces and anxiety whenever even thinking about that time in Paris?

For starters, she refused to sleep without a light on and any bedroom had to be a large one. She realized that that had been a criterion for every apartment she had rented since that summer in Paris: a large bedroom. In addition, she always planned her trips out. She never went out at night when she would be likely to encounter empty elevators. She always was sure to be with other people on elevators. If she faced an empty one, she always "remembered" something forgotten in the apartment or office. That might be contrary to a lot of patients with similar problems whose main worry was having too many people around in elevators or similar places, but in her case, it was being alone in confined spaces that set her off.

Then there was the fact that she never used closed phone-booths—even glass ones. And in restaurants, she always sat out in the open, never in empty dark booths in the back.

The list went on.

Without being consciously aware of it, she had neatly organized her whole life to avoid small, dark, confined spaces. And finally, whenever she felt confined, she would get depressed, anxious and irritable . . . *I'm a classic textbook case*, she decided.

She felt Tuane's attention focused on her self-examination and braced herself to go on.

Treatment plan? No question about that: flooding. Systematic desensitization was another option. The latter approach was similar, but it gradually introduced lesser levels of a phobic situation or object. Building up the intensity like that was effective and less traumatic, but it was too time-consuming. Under the present time constraints, she had to cure herself quickly, to demonstrate that she could do it.

She recalled the power of Tuane's mental imagery and had an idea. [*Tuane, you have been listening. Now assist me. Do you recall the incident I remembered in the tall tower? When I was trapped?*] She felt the Centaur's nervous agreement. [*The part where I was trapped in the small room.*] she reassured him. [*Well, I want you to build that imagery up in your mind and draw me into it. Your people use your minds as the primary means of communication and they are stronger than ours for that purpose. Place me in that room. Dig into my memories and make me relive that incident.*]

[*But to do so would distress you.*]

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[*That's an order! Make me relive that night!*]

And he did.

Once again, she inspected the unmarked door in the back of the gift-shop and she heard the door swing shut and latch behind her. The light from the hall cut off to leave her in a blackness so complete that it felt like a smothering blanket that tried to insinuate itself into every body opening. The darkness forced itself down her throat, burrowed down into her guts and then back to twist itself around her spine and to squeeze relentlessly until she was screaming . . .

Suddenly she was back in the hotel room, hands crushing crumpled sheets of Tuane's itinerary. Jimmy was shaking her.

"I'm not sure who was first. Tuane kicked you loose at the same time as I tried to snap you out of it."

"I'm OK, Jimmy. Thanks." She took a deep breath and clenched her hands to stop them from shaking. "But next time, don't pull me out of it. I've got to do this myself."

Jimmy looked doubtful, but he moved back to his seat and replaced his own helmet, even as Anna forced herself to pick hers up and put it on.

Tuane's concerned thoughts hit her right away and she felt a surge of irrational anger. [*Don't pull me out until I tell you! Return me to the room*—]

[*But it was distressing you too badly.*]

[*That's the purpose. You must continue to expose me to that memory until I stop reacting irrationally. But do not repeat my emotional reactions. Only recreate the actual physical setting, can you do that?*]

[*Certainly, that will be simple.*]

[*Great! Do it, and keep doing it.*]

Again she found herself trapped in the tiny storage closet. As the darkness swallowed her, she felt her pulse racing again and the icy claws of fear pluck the individual nerves of her body. But this time she only felt her present fear. She realized that when she had asked Tuane to replay her imprisonment before, he had also replayed her panic, which, when added to her new fear over feeling trapped, had been too intense to handle.

This time, she would only have to face the actual situation, and it should be easier.

But not much.

She felt the soreness of her throat as she called on strained vocal cords to scream for help, again, knowing that somewhere out there, eventually, there had to be human union crew-bosses. She also felt the growing hunger in her stomach and the soreness of her fists as she beat them against the door. But then panic overwhelmed her again and the chamber faded around her. Tuane had pulled her loose.

[*Again.*] she called out to him. [*I'm still losing myself in fear.*]

And again, and again, she was thrust into the tiny utility closet. But each time, the shock was less. The automatic panic eventually failed to appear, and she found herself grumbling instead over the empty ache in her belly, her sore throat, and the parched wasteland of her mouth.

It was just a small, uncomfortable room, she gradually realized. The fear

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was gone. She felt an incredible peace, all at once.

[*Thank you, Tuane. I'll be back.*]

Sighing, she removed the bulky helmet and shook her head over its ugly design and awkward positioning. It was only a tool, she realized, nothing to fear.

Jimmy was staring at her across the table. He looked ten years older and he had already taken his helmet off.

"I'm sorry. I had to pull out of there the third time out. It was getting to me. Did it work?"

"Yes!" All at once it hit her: "I'm cured." She hefted the bulky helmet. "Sorry, I've got to talk to Tuane." She slipped it back on, annoyed only by its awkward weight now . . .

She called out to Tuane. [*There! Do you understand? Constant repeated exposure at full force to the feared situation or object reduces its power to frighten. The body just can't keep pumping out adrenalin—or whatever your equivalent is—and rouse the body to panic repeatedly. Eventually, the body gets tired of it and you find yourself able to get past the fear and realize that it is irrational. There's more to it, of course, but—*]

[*I understand what you mean, and I would extrapolate that in treating another, the procedure would be accompanied by suitable instructional material to illustrate the harmlessness of the feared object or situation. Having seen the principle illustrated, its logic is irrefutable. My only remaining question is its applicability to my own problem. You theorized that I have a fear of heights and open spaces. That is true. But you must understand that in addition to the differences in our appearances and physiological mechanisms, we differ in many other ways. Very importantly, where your fear was an irrational one, mine is not. Under the gravitational conditions of my planet, a fall is frequently fatal—*]

[*But your species—*]

[*I know, you think we are proportionately more protected and stronger than your species. But we're not. There are limits to the strength of organic matter. We are stronger and more resistant, but not as much as you might think—*]

[*But we're not on your world! We're on Earth, with only half the gravity of your world. Let's focus on the present problem. Your problem here, then we'll worry about the rest.*]

Tuane didn't respond for a while, and then she felt him yield. [*Agreed. We will try your treatment. But I will begin by showing you why I have the problem I do. You need to know that. So, observe . . .*]

Suddenly Anna found herself submerged in Tuane's memories again.

He was on a school field trip. The class was investigating "geological" oddities; specifically: a recent fault crevice that had developed after a series of quakes had ripped apart an isolated section of a park. The deepest points of the crevice dropped almost three hundred body heights and were totally hidden in the darkness below.

On a dare, he approached the edge of the cliff. Instincts fought with the tantalizing hope of a major class status boost when the word spread

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of his bravery. The proof would be a vertical picture taken down the edge of the cliff with his personal recorder.

He was holding the recorder steady over the edge, aiming the lens down into the crevice, when a faint, delayed after-shock shook the area. The freshly exposed rock of the ledge under him was unsteady to begin with. As faint as the tremor was, the edge of the cliff began crumbling and Tuane found himself slipping towards the disintegrating edge. Frantically, he lashed out, trying to grab onto anything solid as he scrabbled to get away from the plunging depths behind him.

Suddenly, the rock sheet he was perched on swung loose and spun towards the edge. He found himself staring straight into the yawning depths of the ravine that was straining to swallow him. For an eternal moment the slab of granite under him wobbled precariously, half on the cliff-side, and half hanging unsupported over the edge. Tuane was frozen with panic.

Then, heavy cables suddenly wound themselves around him and he found himself pulled away from the edge. His legs folded under him and he collapsed, letting himself be dragged to safety as the world spun into darkness.

For a moment she hung in that darkness, and then she sensed Tuane's thoughts again. [*That is where my fear originated.*] he explained weakly. She realized it must have taken an incredible effort for him to replay that memory for her.

She felt shaky herself. It had been so real! She literally felt as if it had happened to her. She wasn't sure how *she* would react at that moment if stuck up high somewhere.

[*I'll be with you in a little while.*] She had to take a rest . . .

She reached up to remove her probe-helmet, seeing Tuane bobbing his rear in acquiescence on the other side of the Plasteel. She recognized the gesture of submission. She was absorbing more than she thought from her contact with the alien.

As she laid down the helmet and got up to stretch she was startled by the sound of the door to the hall opening. Paul came in, looking worried. "Anna, are you all right?"

"Yes, I'm fine . . . Are you monitoring our session?" She remembered how he had known when she had aborted her first attempt at communicating with Tuane. She spun and stalked towards him, glaring. "That's privileged information, damn it! Jimmy is here because he's my back-up and he knows the equipment, but why are you?"

Paul captured her hands gently. "I'm not. But the Centaurs are. The computer for the probe set-up is right there on their ship, after all. They're just taking the opportunity to learn more about us. While Tuane is in there," he nodded towards Tuane's room, "his 'output' is boosted and they are in constant contact with him. Not that he has been acknowledging them—"

"So how do you know what's going on?"

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"They told me. And they just told me that he's communicated directly with them for the first time since he flaked out . . . sorry. Bad term, but you know what I mean."

She nodded, head swimming as she realized what he was saying. The whole Centaur mission was in her head when she was linked with Tuane!

Paul's voice was gentle. "I have to tell you, you're picking up quite a fan club."

She realized he was still holding her hands—and he wasn't just talking about the aliens. His admiring expression made it clear he was including himself.

Jimmy startled her as he tapped her on the shoulder. He had come up behind her without her realizing it and he had an "I told you so" expression plastered on his face. "I'm going to take a breather. Call me when you're ready to continue."

"OK," she answered absently. She turned back to Paul as Jimmy left. "What do you mean?"

"I mean they are very impressed by how you're doing. They tell me that you revealed personal weaknesses to Tuane that could be very embarrassing to you, risking a great loss of status. And all to help him—which you are doing."

"Did you ask them about my problem?" His brief, embarrassed expression was answer enough and she had to smile. "It's OK. I'm . . . was . . . claustrophobic. Something that happened while I was on vacation years ago. And Tuane is acrophobic . . . he has—"

"I know."

"Right. Well, to help him I had to . . ." She went on to explain her strategy for treating the alien ambassador. As she talked he led her to a low couch in back of the room. They sat down next to each other and she tried to ignore the enigmatic black gaze that seemed to follow them. Paul's leg was warm against hers and she almost screwed up her story. He still held one of her hands and she felt herself blushing as she finished up.

Paul leaned back and whistled softly. "That must have been rough! Do you think he'll respond—"

A soft thud startled them and they looked over to see Tuane struggling to rise from the floor. From what Anna knew, something severe must have happened. The Centaurs never lay down except when sick or injured. Fortunately the light gravity helped and Tuane was on his feet even as Anna slammed down the probe-helmet over her head in alarm.

[*Tuane,*] Anna called urgently. [*Answer me! What's wrong?*]

[*Nothing, Healer. I was just testing a theory.*] Tuane's clear answer was immediate. [*I have been continuing my treatment. I did not think it was necessary to distress you any further, so I have exposed myself to the memories of my guided tour of your world.*] For a moment, Anna felt a flash of suppressed panic from Tuane. [*I was just proving to myself how safe your world was by jumping up and landing on my side. Something which would be dangerous on my world, even without the jumping, which would not be possible to the degree that I can do it here. And as you see, I am totally unharmed, not even bruised.*] There was an almost manic air about his thoughts.

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[*Tuane!! Listen to me. That's good, but even here you need to take care. When you're out of your quarters, a fall can still kill if it damages your suit.*]

Tuane was instantly more rational. [*I know. But you must understand, I have been unable to face many situations because of my fear. I have been careful to plan my life to keep safe.*] Anna felt herself smiling sympathetically under the helmet, remembering her own careful planning. [*I have lost much.*] He was thinking of Mianne so clearly that Anna felt it, too. [*I must prove myself. I took this mission because your world's traumatic scenery is well known, and our strategists determined that it would be a difficult experience for any of our race to come here. I volunteered for it to prove myself. To Mianne and her village. And my race.*]

For a moment she felt Tuane's mental barrier slam shut again, and then it lifted. His thoughts were suddenly sharper, and somehow more official. [*I am ready to resume my duties.*] She sensed that he wasn't talking entirely to her. Then he did speak to her: [*Healer, you have performed your duties well. Thank you, but I will no longer require your services. Please disengage your helmet.*] The dismissal was clear and she almost felt as if she had been physically slapped.

Hurt, she removed her helmet. "Well, you're welcome!" Tuane had his back to her and was in the process of donning his atmosphere-suit. She saw Paul's reflection in the Plasteel window and turned to him, trying to keep calm.

"What's wrong . . . Anna?"

She explained Tuane's brusque dismissal, and felt like such a fool because she felt her eyes burning. This was too much like a rejection, she realized.

Paul looked up angrily and started to say something. But then his mouth snapped shut and he smiled. "Sorry, but I'm going to get personal for a second. Are you involved with anyone right now?"

"What's that got to do with anything?"

"Please. I have a reason for asking. Are you?" She shook her head silently and he breathed a satisfied sigh. "He would know that, wouldn't he?" Paul nodded in Tuane's direction.

Anna sat up, startled as she saw what Paul was leading to. "Yes . . . he was in my mind practically the whole time, and I have the feeling he got more from me than I did from him."

"I'm sure he did. They've been studying us for some time. Better than a century. It's not general knowledge. They were afraid of upsetting us by admitting that they have been using a remote version of this probe thing to interface observers into the minds of selected humans in order to learn as much as possible about us. We figured it out, though, because the Contact procedure was too easy. They knew too much about us. We went from a carefully staged First Contact on a colony world to exchange of information in a ridiculously short time. I played a hunch and confronted my Centaur counterpart about it. Lying didn't work well through the communications link we had established, and they admitted to having studied us. After that, it went much faster since they didn't have to pretend

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ignorance. Both of us gained status." He grinned.

"Another hunch, huh?" She returned his smile, feeling his hand tighten over hers. "So, why *did* you ask about my relationships or lack of?"

But she suspected the answer even as Paul explained. "Tuane had to be cold and dismiss you, now that he's cured. As long as he was a 'patient,' he was your subordinate, but as soon as that changed, he is again the Ambassador from his world, and you're very much subordinate to him—"

"Status, again." She nodded. "So he has to be aloof."

"Exactly. But he knew you were lonely. And from what you told me, he knows a little about how it feels to be lonely—"

"And rejected!"

Paul raised an eyebrow, but didn't pursue it. He obviously understood. "Exactly. And he had dealt with me using the helmet, too, and probably knew a little about what I value in a woman . . . and that I'm also lonely." He shrugged as he made the obviously difficult admission.

Anna took a guess. "And he sent a message to the ship that you should be sent here—"

"And to make certain I'd get here quick, they told me you were in distress."

She remembered how he had come bursting in, obviously worried after her shock-exposure to Tuane's traumatic childhood memory. She looked at Tuane tenderly as she realized what he had tried to do. "Which means that they—"

"They knew how I felt about you."

His words hit home and she felt suddenly weak. "Did you have another hunch about me?" She remembered his embarrassment when she had asked him if he had tried "hunching" for a girlfriend.

"Yes. I'd like to give it a try. And I could really use you around here, too. You won't believe the status you'll have generated for yourself by curing their ambassador and assuring the success of the treaty signing. It will mean guaranteed status for all the Centaurs associated with the mission, and they know they owe you. We can work side by side bringing our races together—"

"And in our free time, we can see about bringing something else together." She felt a sense of overwhelming excitement come over her. This was the chance of a lifetime professionally, she realized. And personally, too, she had a hunch as his hand reached for hers and held it warmly.

As they approached the door, she looked up at him slyly. "By the way, what happened that time when your hunching failed you?"

Paul blushed. "I'm not saying. Not unless Jimmy tells you about Betty's sixtieth birthday party . . . let's just say they're related and involve fermented beverages. . . ." ■

●Posterity is nothing more than a new public that has succeeded its ancestors.

S.R.N. Chamfort

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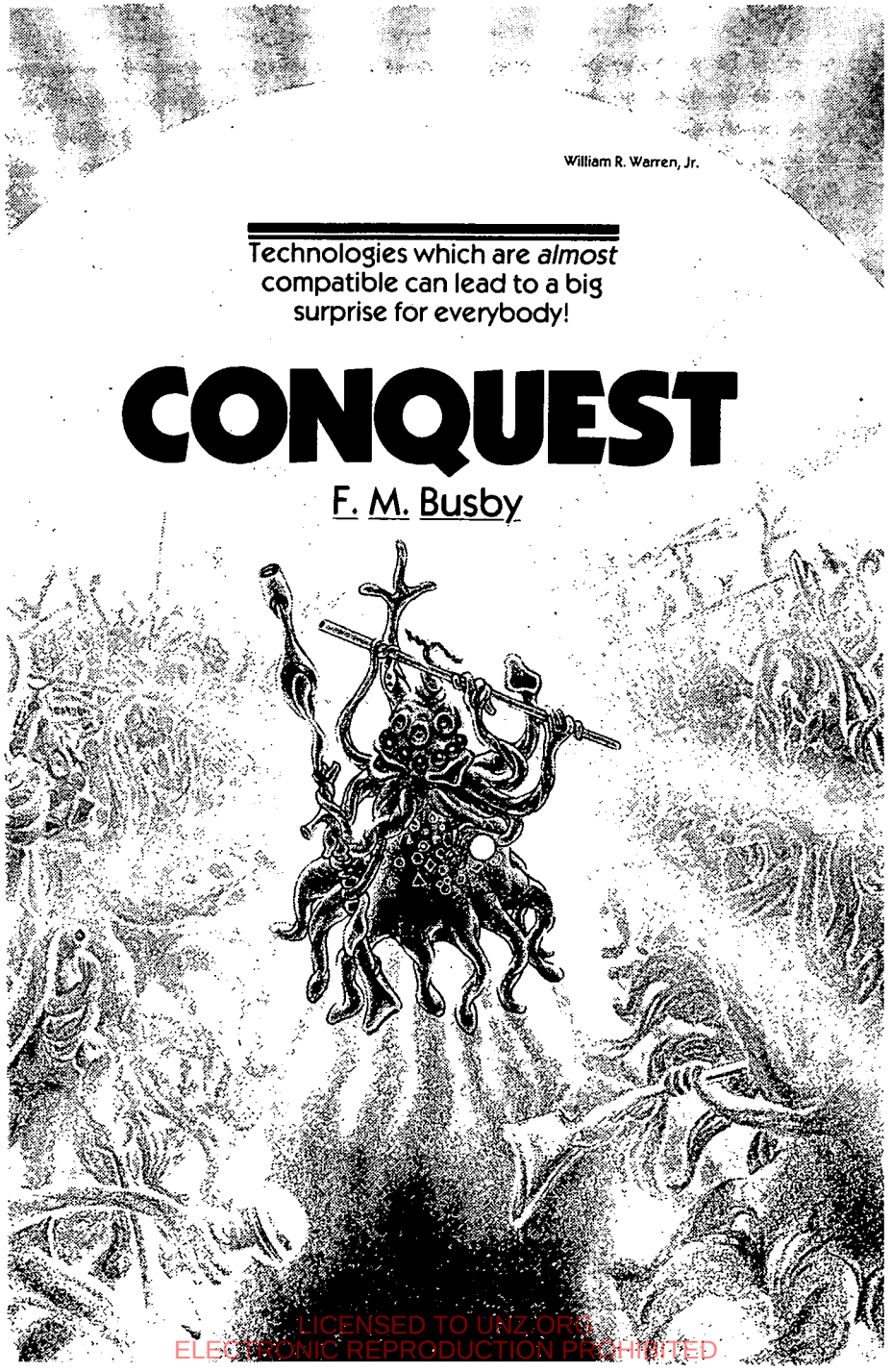
William R. Warren, Jr.

Technologies which are *almost* compatible can lead to a big surprise for everybody!

CONQUEST

F. M. Busby



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The first time that Junior knew there was a problem, he was bringing a load in from the pickup and his ma yelled, "Dorsey Ragan Junior, how come you can't keep that Haitch-Vee runnin'?"

All day he'd been in town, down to Potlatch buying up supplies, but now Junior shifted into hillboy gear. Two years in the army, he'd learned what-all about electronics, but one other thing, too: be what folks expect of you. In town he talked town, but the farther up the canyon he got, the more country he talked. And the Ragan farm was right up top the canyon, just below where the little river dropped down and widened out a gorge for itself, on its way to the Palouse. So he said, "That there thing gone haywire again?"

"It shore has. Fust thing this mornin', turned it on, got nothin'. You take a look, Junior?"

"Soon's I get the truck unloaded." When she nodded, he went on out by the barn where he'd left the pickup, and offloaded a couple more heavy bags. Thinking, what could be gone wrong with the HoloVid? He'd rebuilt the thing, *and* the VDR with its laserdisks, using high-fidelity wideband components.

Why, he had an audio feed from a fancy burglar alarm system in there, it went clean up to forty K, iffen anybody could hear that high. All told, he'd put-ten together a system, disk and all, which could've handled maybe fifty times as much bytesize as that there High-Def H-Vid signal needed. Like supposing the networks wanted to add smells, on top of just shapes and sound and color. Digital stuff worked like that.

Some few things he'd high-graded from Salvage at the Fort, whilst he was waiting around for his discharge; others he'd traded for at Sid's Electronics in town. A few things he'd paid cash money for, even—like the big dish, and the reel of optics fiber cable to hook it up with. All told, pretty much the same way he'd scrounged together the hydro-generator for the dam that made the nice wide pond in the creek, just below where it come splashing down.

He'd thought the H-Vid setup, with the VDR, was a solid job. But some piece of it must've smoked out. Looked as if he'd have to shoot him a mite of trouble, then maybe dig into his junk box some more to see what might work as replacement parts. Back in the house, putting groceries and other stuff away where it belonged, he tried to figure out which place to start.

Amid normal polyphonic discussion by all, none detracting from the luster of the event by keeping silent, Pilot Lemyrt brings the Hrokkan scoutship to landing. As ordered, he-2 has approached the blue clouded planet to enter atmosphere near an axis point—then, to reach destination, has skimmed low, close to the surface. Thus avoiding detection by this world's present inhabitants.

Most important, stated the Great Ship's captain when dedicating the scoutship to its planetary rendezvous, is that these sentients not know of Hrokkan existence until Hrokkans are deployed in sufficient numbers to take the planet firmly in grasp. Thus, she-3 has emphasized, the scoutship is to establish

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bridgehead—where Hrokkan hordes are to appear before spreading to overwhelm and triumph—in a place inhabited sparsely or not at all, yet at the same time near to modes of transport and to centers of population large enough, in case of need, to be valuable as hostages.

Also, the designated terrain must be suitable for establishment of a large, albeit temporary, base camp.

Adjudging all criteria, Lemyrt has chosen an isolated strip of flatland. Above it are hills cloaked with semirigid branching plantlife; below lies a precipitous gash, opening out into rolling swells—among which, habitations may be noted.

The autochthons, Lemyrt feels, pose no real threat; he-2 finds them unimpressive. Short and stocky, with only two rather small eyes and that same number of upper limbs and lower limbs, none whatsoever in the bodily region between. They remind him-2 of certain toys of simplified construction, designed with grotesque imagination for the amusement of Hrokkan young.

During approach, all appears well. Upon landing, the first reconnaissance pentad reports that the scoutship, grounding, has destroyed some minor native-built artifact.

Annoyed, Pilot Lemyrt interrupts his-2 program of orders detailing construction of the Receptor, to note this trivial anomaly.

The H-Vid itself was perking along just fine. Junior found that out right away, playing the first few minutes of an old movie he'd disked a while back. When it came to troubleshooting, Junior Ragan kept in mind what his granddad used to say, "Allus try the easy ones fust." Often as not, it paid off.

His ma wouldn't've tested that way. Ever since she messed over the head end of her Grand Ol' Opry Recollections disk with a talk show segment, hitting Record when she meant Play, she just wouldn't have no truck with handling the VDR, at all. Any time she wanted to watch something off it, somebody else had to work it for her.

Anyway, now Junior knew the trouble was ahead of the disk recorder, in the feed itself. Just to make sure, he unplugged the cable and put a signal analyzer on it. Right the first time: nothing coming through. His impedance checker, then, showed neither a proper match, an open, nor a clearcut short.

Seemed like something must have diddled with the cable: mashed it, maybe. Junior went and looked out the back window, upcanyon toward the steep trail alongside the creek, where the cable ran up to high ground and then on back from the edge to where the dish was set.

Getting too close to dark, now, to climb up there. Early tomorrow, maybe, after chores.

For tonight—well, in town today he'd traded Sid out of a couple of new disks. They should ought to keep the family happy, right enough. 'Cepting, with Pa tooken Big Sis Abby Fay downcanyon to help Aunt Marg'ret with her new young 'un, and Little Sis Carrie June staying at Swishers' overnight after Jennie Swisher's birthday party, Ma and Dorsey Junior was all the family there was, tonight.

Under Pilot Lemyrt's guidance and

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their own supportive vocal interplay, Hrokkans are well along toward final assembly of the all-important Receptor. The parabolic signal-catcher is erected, then aligned toward the position the Great Ship will reach at the proper time: the crucial period when Hrokkans will pour from Ship to planet.

The Receptor is a solidly-floored curved shell, covered from weather but open on the side opposite the focusing matrix. When transfer begins, Hrokkans will proceed bi-clef by bi-clef, each legging into the Shipboard focus and pausing for transfer. Then, upon materializing, each bi-clef will quickleg smartly out of the Receptor, making way for the next group. The well-drilled Hrokkan troops can be depended on to maintain cadence and keep the operation moving smoothly.

Lemyrt wishes he-2 could be here to see that stirring sight. But his orders are to complete the Receptor and test all its functions in simulator mode. Then he-2 is to take his scoutship on an outward-spiralling pattern, making a visual record of surrounding terrain for use by the landing forces' commander, and posthaste deliver those data to Captain Nebol aboard the Great Ship. Lemyrt desires that she-3 be appropriately pleased with his-2 overall mission performance.

Laboring with enthusiastic voices, Hrokkans bring construction to fulfillment before darkness arrives. Testing, by Pilot Lemyrt, consumes further time. When he-2 pronounces the Receptor operative, orders all Hrokkans aboard the scoutship and lifts it to begin the recording spiral, light of the new day encroaches at the sky's leading side and begins to grey it.

* * *

By the time pa got home, stopping by Swishers place to fetch Carrie June, Dorsey Junior had all the stock fed, the cows milked, and was in the henhouse gathering eggs.

Chilly out, this time of the morning, even in summer. He was getting mighty hungry, too; every time he passed downwind of the house he could smell bacon frying. Breakfast was no hurry, though; he hadn't smelled pancakes yet. Well, he wouldn't, not 'til Pa and Carrie June was back. But here they come now, and Ma on the porch to meet them. As Dorsey Junior brought the eggs.

"Marg'ret?" Pa was saying. "Oh, she's jest fine. Moughty loud young 'un she's got herself, there."

And Carrie June plain busting to tell all about Jennie's party. Going on sixteen, Little Sis was: old enough to fret Pa when the boys started hanging around, as they was. But not at Jennie's party; just girls for that one. Neighbor girls; up and down the canyon maybe eight, all told, near Jennie's age.

Inside the house, now, ever'body set down to eat; Ma brought bacon, eggs, pancakes, corn bread, applesass and coffee. Milk for Carrie June; she hadn't yet got her the taste for coffee.

Setting down herself, Ma tooken a bite of pancake before she said, "Dorsey, Junior? You got that Haitch-Vee fixed?"

"Not so far, Ma." Before she could ask more, he said, "It ain't the set; remember? 'Cause we played them disks last night. I got to go uptop the canyon and see about that there cable."

"Wal, just so you get 'er done by tonight." Because tonight there was

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some of Ma's favorite shows on. And since the whole family was going in town for the fireworks, Dorsey Junior had to have the VDR set up to disk 'em for her while they was gone.

So Junior said he'd sure do his best. And once his chores was done, he checked his kit to be sure he had all the tools and parts he'd prob'ly need, and headed up the trail.

By now it was warmed up some, but still the shady-side leaves brushed dew onto Dorsey Junior's old denim pants. And here and there, where the creek fell steepest, spray come off of rocks and splashed him good 'n' cold.

Looking along the cable he didn't see damage. By the time he hit the top of the canyon, seeing off to the hills across mostly flat country with a little roll to it, he's worked him up a good sweat. But didn't hardly notice, because squat out there, not too far, was something newly built.

Two somethings, really. A big ol' dish, five-six times the size of Dorsey's, and some kind of daggone whoppin' bandstand. Where they could've come from, Dorsey Junior had him no idea. But there they was, looking all bright-spangy new.

And where his own dish ought to be—well, it was there, all right, only mashed out flat, support stand and everything. Grass and small brush squashed down, too, all around for quite a ways. Like somebody sat a big ol' granddaddy stoneboat down there, or something like that. But just sat it and tooken it up again, because there wasn't no marks at all, of anything chewing up the ground outside that one place.

Dorsey Junior went and took him a closer look. The dish was mashed to kingdom come, all right, with the little antenna stuff at the middle of it broke clean off. And like he'd thought, one place the cable looked pretty bad chewed up; some kind of hard edge must've sat on it.

Ma, she wasn't going to like this. So he better do something about it. And since whoever set that big dish up, and strung a cable from it to that big ol' bandstand, had to be the same folks as squashed *his* dish—why, by golly, he'd just hook up and use *theirs*. Cut their bandstand loose to do for itself.

Serve 'em blame well right!

He looked at what there was to work with, and it wasn't hardly enough. "Them two cables won't splice," he said to himself. "Too different."

He thought of it. "What I *could* do, though, is saw off and transduce-terminate the both of them on a half-wave piece of optic waveguide between, for a coupler." Or was it quarter-wave?

Never mind; down at the house he could look it up.

Accepting Pilot Lemyrt's report amid enthusiastic polyphonic commentary by assembled crew members, Captain Nebol on behalf of all Hrokkans present or elsewhere expresses gratitude and appreciation —for and of, respectively—his-2 achievement. She-3 then obtains the august presence and ineffable response of Troopsdisposer Flazin, all necessary that the next stage of the Great Ship's mission may proceed.

Arriving promptly, Flazin adjusts his-

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4 formal ornamentation and makes his-4 proper ceremonial plea for further instruction.

Never one to see time elapse unavailing, Nebol obliges. The next step, she-3 informs him-4, is debarkal and disposation of all Hrokkan troops assigned to assimilation of this planet. Five myriaments in number, divided into units of which five fives comprise one myriament, these finely-equipped Hrokkan units will assemble near the transfer focus and await glorious initiation of debarkmentation.

That sublime moment, she-3 now informs all assembled Hrokkans, will follow the onset of darkness at the Receptor site by a period equal to one-tenth of the planet's rotation.

By the time Dorsey Junior had them cables hooked proper to his piece of waveguide, and all, there warn't time for more'n to be sure the hookup passed signal like it should ought to, and punch Ma's programs up on the VDR controls. Why, for a bath he had to make do with a quick dip in the cold creek.

Then it was time to pile in the pickup and head for town.

Superbly ornamented, bearing the most destructive energy handweapons known to Hrokkan science, the troops assemble. Surrounding Hrokkans fill each others' aural registers with approving commentary.

Now the time arrives. Following Flazin's rhythmic, crowd-echoed orders, bi-clef after bi-clef enters the transfer focus, to vanish from the Great Ship.

Troops disposer Flazin stand-kneels waiting, as one after another his-4 myriaments move to the transfer focus area, there to appropriately vanish. Last of all, he-4 and his-4 honor escortment approach their departation point. Just before reaching locus, Flazin turns to Captain Nebol and makes ritual gestures of homage and dedication while, in counterpoint to bevy of voices massed in farewell, he-4 utters the testimonials designated for one leading troops to Hrokkan domination of a new planet.

Then Flazin and his-4 escortment themselves enter the transfer focus. The moment comes; the surround flickers.

The fireworks had been pure whopping fine. They went on so long, though, that the family was real late getting home. Driving up to sit the pickup alongside the barn, Dorsey Junior was glad to be back.

While his pa helped ma get unscrunched from sitting in the middle and got her down feet-first out of the cab, Junior went back to see how Carrie June was a-doing. He figured Little Sis to be asleep and there she was, all curled up blanket-wrapped, braced between the front of the pickup bed and two sacks of hog feed overdue for unloading.

He was going to wake her up all cheery like, but she looked so sweet and tired, there in the dim Moon on account of thin clouds blowing past, that he got her up and out and into the house without hardly rousing her.

Ma said, "What in the world—?" Then she saw what was what. "All right there, Dorsey Junior you. Give me that child and I'll see her off to bed."

"Thanks, Ma." Pa wasn't in yet. Probably still in the outbuilding. So Dorsey Junior went outside and did by

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a tree. On account of he always kept in mind that good folks never do too close to the house.

Guys in the Army, flatlanders and all such, used to josh him about stuff like that. But he figured it just went to show: if people don't know what's polite, they won't take to being told.

Back inside, before going to bed he checked the VDR. Yes, the indicators said it had put Ma's programs on the disk right enough: time it started, time it stopped, the right channel. All the stuff this model told you for the asking, that the older ones hadn't. Dorsey Junior shut the machine down and went to bed.

Flazin never accustoms his-4 self to the sensation of transfer; always he-4 suffers disorientation and requires time to recover. But this time recovery does not, to all seeming, occur. Thought and body frozen, he-4 experiences no light, no sound, indeed no sensation whatsoever.

Yet he-4 indubitably exists—and in some way not understood by him-4, the presence of the transferred Hrokkan myriaments is also sensed. For an immeasurable period of no-time, in no-space, this condition persists. Until, of a sudden—

Troopsdisposer Flazin, stand-kneeling once more, looks around his-4 position: startlingly, not at the expected dim planetary surface and dark, star-flecked sky, but at a glowing surround of indefinite extent, flickering at subliminal speed. And in every direction, fading into distant haze.

Other Hrokkans appear similarly affected; less than half contribute to normal polyphonic background interplay.

Flazin draws and fires the most powerful hand weapon known to Hrokkan science. At some far point, deep in the haze, a faint flare of light is produced. His-4 weapon causes no other result.

And then Flazin finds him-4self again in no-space.

Ma was really peeved. "Jest what did you do there, Dorsey Junior? To my Haitch-Vee and my VDR? Jest *look* what you disked for me last night whilst we was in town. That stuff ain't my programs, nor ever nothin' like 'em."

"Lemme have a squint there, Ma." She'd turned everything off, waiting for him to come in from chores and have him some breakfast. But right now, Ma sounding the way she was, Junior figured breakfast should maybe wait.

So first he tried the H-Vid by itself. And found, wasn't no channels coming in, at all, off the cable. So he turned on the VDR. Ma had just plain disgusted cut it off dead in mid-run; Dorsey Junior reset the program to Start and hit Play.

'Course, Start wasn't never twice the exact same place.

Recovery from transfer always takes Troopsdisposer Flazin longer than he-4 would like. Now, shrugging off hazy memories of having seen this before, he looks around at a strange, unbelievable, indefinite space surrounded by glowing haze.

A member of his-4 honor escortment draws his-1 hand weapon, but Flazin tells him-1 to resheath it and reflap his-1 mouth.

There is, so Flazin is betaught, no point to essaying use of force without

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probable benefit.

But after a time the Troopsdisposer tries his own weapon. Aside from a burst of light in distant haze, it produces nothing.

Nor, when Flazin has all his troops deployed in the most effective formation for concentrating their firepower, do the weapons of all five myriaments entire.

Sure as shooting, that warn't no more Ma's programs than the man in the Moon. First-off, Dorsey Junior thought all them little army-leggy critturs, with the shiny decorations on, was cartoons or Claymations. Squinting closer, though, they looked more real. If any such funny-seeming things *could* be real.

With all them extra limbs a-waving, and big flappy mouths aworking, seemed like there should oughta be more noise. But all he heard was feet stomping and such. Didn't rightly make sense, so Dorsey Junior hooked him a freq-meter into the audio feed which he gotten out of that burglar alarm. Sure enough, they was sounds on there—but up around twenty-five to thirty Kay-Hertz, pitched for hound dogs and no use to human folk.

More'n one way to skin a mule, though. That there alarm system picked up them doggy-ears noises and shifted 'em down for people. Kind of a cute trick, he'd thought.

Dorsey hadn't hooked up that part, no reason to. Now he did. And sure enough, the little buggers in the H-Vid sang right up and whooped like crazy. Like nothing Junior ever heard before in his whole life: no words to it any way at all, just hoopie jibberjabber. But catchy, sort of.

Then one of the little spridgets, there had to be *thousands*, and this one the fanciest decorated of the whole shebang, it pulled out some sort of overgrown flashlight and shot off a lightbeam, right out of the H-Vid except it faded after a couple of feet.

Dorsey leaned closer, just when the whole lot inside there pulled out their handlights and let fly. "Ow! Drat all!" Rubbing his face right hard, he turned the VDR off and jumped back. His skin burned and prickled, and afterflashies colored his seeing, but after a bit both effects eased off.

So Dorsey Junior, he reset the disk again and started over.

Flazin never recovers quickly from transfer, but these recurrent illusions of no-time are something new to him-4. Now as his vision clears, he sees again only glowing haze to all sides, thin near at hand but thickening to hide what revelations farther distances may hold. He-4 sets his handweapon for simple illumination but its beam cannot disperse the haze. Pitching his-4 voice above the arrhythmic interplay of all the myriaments' intonations, Flazin orders all Hrokkan troops to assume standard formations and follow him-4. Since no portion of the hazed perimeter offers advantage over any other, he legs straight away in the precise direction he happens to be facing.

The thing about this here program, Dorsey Junior told his folks, is that you start it up and every time it's different. Ma could appreciate that, even if she did want him to get uptop the canyon and fix her Haitch-Vee so's it'd work like it should ought to. In fact she kind

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of liked the caterwauling, and the jumping around which them little smoofers did sometimes. So Dorsey Junior copied the disk off onto another one, only feeding the audio through his freq-shifter so you could hear the sound on any machine, not needing no shifter.

Naturally, once you turned the disk on, either one, everybody had to stay back two-three feet, in case the whatsits started shining their little flashlights around. So's they didn't sting you any.

Still, though, Ma wanted her H-Vid fixed to work right. So Dorsey Junior went back up topside the canyon and fiddled his length of waveguide until he could get regular signals through it. He had to jack the big dish around some, too, so it was pointed better. But by noontime, when he come on down for dinner, he had it working just fine.

Next time Dorsey Junior went in town he took the funny disk along with him to Sid's Electronics. The first H-Vid they tried to play it on, nothing come through but what looked like a stillholo until you watched a spell and noticed it did move, but real slow. "Cheap set," said Dorsey Junior. "Not enough bandwidth." So they set it up on a top-of-the-line model, near as good as what Dorsey'd flanged-up for Ma, and Dorsey Junior set back to enjoy Sid Dailey's surprise.

He let Sid get bit once, just for fun, before he told him about staying back from the H-Vid. Well, Sid would've done him the same way; wasn't like there was any real harm to it.

Seeing how the disk never played twice alike, Sid was impressed. "I'll tell you what, Dorsey Junior. I have this brother-in-law back East around Nashville, he knows some people in the music business. I bet he could sell a few of these. And I'll give you—" Sid paused. "I'll give you $275 store credit for that thing."

"I'll think about it," said Dorsey Junior. Sid was a hillboy himself, and all right to dicker with on most stuff, but he'd been in the army longer than Dorsey had, and wasn't a man to play poker with past midnight. Dorsey Junior had a shirttail cousin name of Orval Conner—second cousin, really—a courthouse lawyer, practiced not too far a piece from Nashville. Junior found himself a pay phone and called Orval; after they talked a spell, he went back and spoke with Sid.

"Now here's how my ol' cousin says it might gonna work—"

When Dorsey Junior's disk came out with a label on it, it sold up to platinum figures three times over. Even though a lot of VDR systems needed some real upgrade to play it right.

Not much of a one for hurry, most times, now Dorsey he started out and bought him some few items that spruced the home place up right smart.

Jennie Swisher, she'd started giving him *woman* sort of looks lately and Dorsey Junior kind of liked the idea.

That's why he all of a sudden wanted to fix things. So a wife would be purely proud to move in.

In a way that Troopsdisposer Flazin can never know or understand, Hrokkan myriaments are spread over the planet in numbers beyond their wildest dreams. ■

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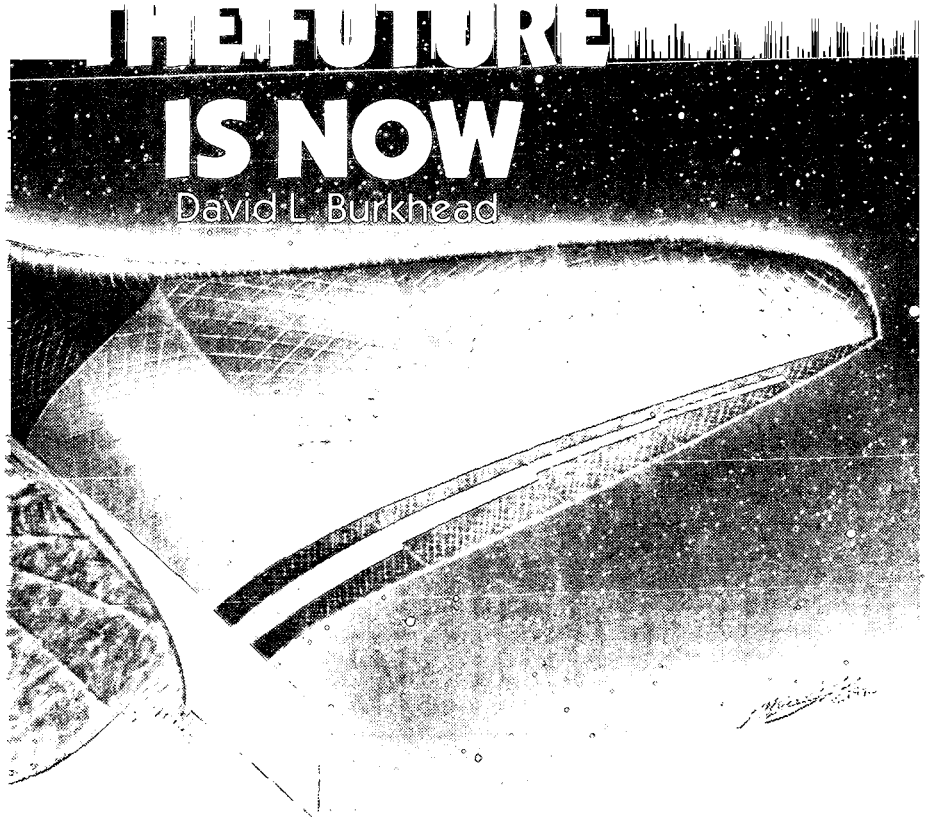
THE FUTURE IS NOW

David L. Burkhead



When a project is too expensive to do in traditional ways, there are two ways to cut costs: cut corners, or find *better* ways.

am R. Warren, Jr.

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July 26, 1996
1432 Halstead Rd.
Akron, OH 44313

Dear Rick,

Did I understand your last letter correctly? You're *quitting* your job to start a new business? If you were going into a realistic business, I'd be behind you 100 percent, but space? Nobody competes with the government shuttles, they're too heavily subsidized, especially the Japanese shuttle. My friend, you are crazy. What does your wife think of this?

Well, I'll have to cut this short. I've got a bunch of freshmen that I have to drum basic physics into. Sometimes I wish that I had followed you out of academe and gone into the private sector myself. Give my love to Marie and the kids.

Your friend,
David

August 9, 1996
Box 32785
New York, NY 10017

Dear David,

Sorry this took so long. I've been very busy.

Yes, I am opening a new business. Marie's not only behind me, she's my accountant. (I told you in college that marrying a business major was a good idea.) Note the address above—it's my business address. At Marie's suggestion, we sold the house to free up some working capital. We've taken an apartment, but it's likely we'll have to move again before too much longer. The kids see it as a grand adventure.

Regarding your comment that nobody competes with the government shuttles; I've just received word that Spaceways Inc. has been formed to do that very thing. I'm willing to bet that I can not only get that order of magnitude that you mentioned, but I can beat out Spaceways as well. They're restricting themselves to off-the-shelf technologies and low development costs. I'm looking at life cycle costs; benefits of living with an MBA, I guess.

As for your remaining in academe, I'll tell you what. You train up some qualified people, I'll give 'em jobs. Fair enough?

Friends forever,
Rick

August 23, 1996
Box 32785
New York, NY 10017

James D. Cunningham
President
Rockwell International, Inc.
Space Transportation Systems Division
12214 Lakewood Blvd
Downey, CA 90241

Dear Mr. Cunningham:

Enclosed you will find, as per your request, the business plan for my proposed venture, FutureTech Industries. As you are aware from our previous correspondence, FutureTech Industries (FTI) will be a corporation which has, as its primary purpose, the commercial exploitation of space. Full details are enclosed, but I will summarize below.

The NASA space station, regrettably, is not a fraction of what it could be. In fact, there is no government program anywhere that truly utilizes space to its fullest advantage. Our plan calls for a

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step-by-step program that will fully exploit the advantages of space travel, to include industrial operations, colonization, scientific research, and mining of raw materials. The emphasis in the early years will be on providing cheap transport into space. Our design goals call for an overall improvement in marginal cost of at least an order of magnitude over the Japanese shuttle, the cheapest of the current launch systems.

The development program will consist of several phases. Phase I, Design/Study, will consist of preliminary studies and research to determine the most economical lines to pursue for such areas as launch and transport into space, and the areas of most immediate commercial value, so as to begin realizing a positive cash flow at the earliest possible opportunity. This phase is expected to require one to two years and a budget of approximately two million dollars. Two systems that currently look promising, and which will be given a great deal of attention, are reusable, single-stage-to-orbit launch vehicles such as the Japanese shuttle; and laser launch systems. (See technical insert.)

Phase II will consist of developmental work for the selected launch system. Fortunately, we expect to be able to borrow a great deal from previous art, such as development of the various shuttle systems and the NASA space station. This will allow us to use a variety of off-the-shelf components. It will require the results of Phase I to prepare an accurate budget and timetable. However, we are currently estimating a budget of five to ten billion dollars and a timetable of approximately five years. Our primary goal is to develop a launching system capable of placing a payload in orbit at a cost of less than $30.00 per pound in adjusted dollars. To finance this phase, we propose a second stock issue with the Phase I investors having preemptive rights.

Phase III will consist of construction of a large space station in geosynchronous orbit. This station will perform several functions: It will be a transfer and refueling point; a communications relay, an industrial center for microgravity, controlled pseudogravity, controlled atmosphere, and high vacuum engineering, and also a center for medical and scientific research.

Also in Phase III, we plan to construct deep space transports, perhaps by converting large, heavy lift orbiters. Finally, there will be the construction of other space colonies, including one or more lunar colonies, habitats at L4 and L5, and possibly one or more at the Earth-Sun Trojan points.

Phase III is expected to cost upwards of twenty billion dollars and take from ten to fifteen years, although construction of space stations and colonies will likely be an ongoing process. In this phase, using various stations and habitats as transfer points, we expect to be able to place cargo on the Moon at a cost of less than 100 adjusted dollars per pound. A third stock issue will finance the early stages, with preemptive rights for Phase I and Phase II investors. Later stages of Phase III we expect to finance internally.

Phase IV will consist of full exploitation. It will include mining of the Moon and asteroids. This far into the program, it is impossible to propose even a tentative budget and timetable.

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All Phase IV work will be internally financed.

As you can see, this is an extremely long-term investment; however, due to the diversity of products and services we will be able to offer, the only serious risk is in allowing the venture to collapse from under-capitalization. All individual aspects have been previously tested and markets are available. Once an economical launch system is available, then mining for materials such as iron, aluminum, and titanium on the Moon alone should pay the costs of development. In addition, there is the almost certain development of spin-off technology.

I hope to hear from you soon.

Sincerely,
Richard K. Schneider
President
FutureTech Industries

September 3, 1996
12214 Lakewood Blvd
Downey, CA 90241

Richard K. Schneider
President
FutureTech Industries
Box 32785
New York, NY 10017

Dear Mr. Schneider:

I regret to inform you that your proposition does not meet our company's requirements at this time. Spaceways Inc. has presented us with a much more attractive offer. Their timetable calls for a first launch a full two years before yours; furthermore, they predict much lower development costs. Were we to finance such a venture, their proposal would be the one we would accept.

I am sure that you understand our position. We have a responsibility to our stockholders not to risk money on such speculative ventures. Nevertheless, we wish you the best of luck on your venture.

Sincerely,
James D. Cunningham
President
Rockwell International, Inc.
Space Transportation Systems Division

September 13, 1996
Box 32785
New York, NY 10017

James D. Cunningham
President
Rockwell International, Inc.
Space Transportation Systems Division
12214 Lakewood Blvd
Downey, CA 90241

Dear Mr. Cunningham:

I am writing to inquire whether you would be interested in participating in FutureTech Industries to the extent of a partial financing? If you are, would you please have a letter of intent drafted whereby you will commit to a portion of the budget, as enclosed, pending our obtainment of the remaining financing.

I believe that such a course of action would permit your company to minimize its financial risks while still participating in a potentially lucrative venture.

I am familiar with Spaceways Inc.'s proposal. It is true that they project an earlier launch date and a lower development cost. We, however, feel that they are making compromises that will be extremely costly in the long run. This is not to say that they will be unable to accomplish their goals. They are a good company. Rather, we expect that our

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life cycle costs will be significantly lower than theirs. As you are no doubt aware, a little extra money spent on development can lead to far greater profits in the long run.

With your history of participation in the space program, it would truly be a shame for your company to lose out on this opportunity.

Sincerely,
Richard K. Schneider
President
FutureTech Industries

September 23, 1996
12214 Lakewood Blvd
Downey, CA 90241

Richard K. Schneider
President
FutureTech Industries
Box 32785
New York, NY 10017

Dear Mr. Schneider:

All right already! Enclosed you will find our letter of intent to finance 20 percent of FutureTech Industries through Phase I, subject to receipt of full financing and subject to renegotiation for later phases. Please have your lawyer look it over. If it meets with your approval, sign it and have a copy returned to me.

Sincerely,
James D. Cunningham
President
Rockwell International, Inc.
Space Transportation
Systems Division

P. S. You should have been a used car salesman.

October 1, 1996
Box 32785
New York, NY 10017

James D. Cunningham
President
Rockwell International, Inc.
Space Transportation Systems Division
12214 Lakewood Blvd
Downey, CA 90241

Dear Mr. Cunningham:

Thank you for your interest. Enclosed you will find your copy of the letter of intent. You will be interested to note that Grumman Corporation is financing an additional 15 percent of the venture. I expect to obtain full financing before the year is out.

Sincerely,
Richard K. Schneider
President
FutureTech Industries

November 12, 1996
Box 1734
Los Angeles, CA 90065

Richard K. Schneider
President
FutureTech Industries, Inc.
Box 32785
New York, NY 10017

Dear Mr. Schneider:

I have just received word about your company's incorporation. Congratulations.

I must say that I am surprised. Your etimated budget is nearly twice ours and your timetable calls for a launch date two years later than ours. How did you get financing? I checked with the SEC and you're strictly on the up and up.

When your business finally folds, as it must—we'll have the market cornered by the time you launch your first ship—there will be a job waiting for you

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here. I can always use a genius at fund raising.

M. L. Gardner
President and CEO
Spaceways, Inc.

December 6, 1996
Box 32785
New York, NY 10017

M. L. Gardner
President and CEO
Spaceways, Inc.
Box 1734
Los Angeles, CA 90065
Dear Mr. Gardner:

I want to thank you for your kind offer. In return, I would like to make an offer of my own: When your company folds, as it must—you are making the same mistakes every space flight company before you has made—we'll be happy to buy off your assets to help defray your debts.

As for your having the market cornered, the only corners will be those that you have to cut to make that killer budget of yours. I expect you'll just have time to alienate all your own customers by the time we're ready to launch.

Sincerely,
Richard K. Schneider
President
FutureTech Industries, Inc.

February 13, 1997
Box 32785
New York, NY 10017

James R. Maxwell
Senior Partner
Maxwell and Associates
Recruiting Service
Box 235
Mar Vista Station
Los Angeles, CA 90066
Dear Mr. Maxwell:

Your firm has come highly recommended to my company for recruiting recent and prospective college graduates.

We are looking to fill a number of positions with recent graduates in aerospace engineering, chemistry, physics, civil engineering, and related fields (a complete outline of the positions to be filled is enclosed). As you can see from the enclosed pay schedules and benefits package, we are paying above the industry standard. In addition, we are offering positions of greater responsibility than are usually available to recent college graduates.

We hope that you will see your way clear to take this contract. We will be willing to pay you an amount equal to 10 percent of the first year's wages of those hired through your firm.

Sincerely,
Richard K. Schneider
President
FutureTech Industries, Inc.

February 24, 1997
Box 235
Mar Vista Station
Los Angeles, CA 90066

Richard K. Schneider
President
FutureTech Industries, Inc.
Box 32785
New York, NY 10017
Dear Mr. Schneider:

We are willing to present your proposal to prospective employees according to the terms stated in your letter dated February 13. We do, however, require a retainer of $25,000 to help

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defray our up-front expenses.

If this is acceptable to you, then please contact us so that we may begin work at once.

Sincerely,
James R. Maxwell

March 5, 1997
Box 32785
New York, NY 10017

James R. Maxwell
Senior Partner
Maxwell and Associates
Recruiting Service
Box 235
Mar Vista Station
Los Angeles, CA 90066

Dear Mr. Maxwell:

There is an engineering physics student at Ohio State University, John Millhouse, that we would very much like to have work for us as soon as he graduates. Would you be so kind as to extend our offer to him? If you can get him, we will double your usual commission.

Sincerely,
Richard K. Schneider
President
FutureTech Industries, Inc.

March 14, 1997
Box 235
Mar Vista Station
Los Angeles, CA 90066

Richard K. Schneider
President
FutureTech Industries, Inc.
Box 32785
New York, NY 10017

Dear Mr. Schneider:

We have made your proposal to Mr. Millhouse, but he has already received an offer from Spaceways, Inc. He has not given them a reply as yet, but they are offering 10 percent more in salary and a comparable benefits package. Do you wish to amend your offer or do we let this one go?

Sincerely,
James R. Maxwell

March 20, 1997
Box 32785
New York, NY 10017

James R. Maxwell
Senior Partner
Maxwell and Associates
Recruiting Service
Box 235
Mar Vista Station
Los Angeles, CA 90066

Dear Mr. Maxwell:

Regarding Mr. Millhouse: use *whatever it takes*. Spaceways can have any of the others, but I want this one. If you should meet Spaceways's representative, please inform him that we will beat any offer that they make by 10 percent. If they threaten a bidding war, remind them that we are better capitalized than they are.

Sincerely,
Richard K. Schneider
President
FutureTech Industries, Inc.

March 30, 1997
Box 32785
New York, NY 10017

John Millhouse
2350 Grange St.
Columbus, OH 43321

Dear Mr. Millhouse:

Welcome to the FutureTech Industries team! We were delighted to hear

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from our representative that you were indeed interested in coming to work for us. FutureTech needs people like you.

Your senior thesis on the strengths and weaknesses of laser launch systems was a brilliant piece of work. Due to this thesis, we are placing you at the head of the Orbiter Development Team. We realize that this is a great responsibility, but we have every confidence in you.

After graduation this June, contact our Ohio representative to arrange for relocation. We will, as promised, pick up the costs of moving as well as assist you in finding housing here.

Sincerely,
Richard K. Schneider
President
FutureTech Industries, Inc.

P.S. Good to have you aboard.

April 15, 1997

Richard K. Schneider
President
FutureTech Industries, Inc.
Box 32785
New York, NY 10017

Dear Mr. Schneider:

Have just received your letter dated March 30. Head of the Orbiter Design Team? I'm flattered. It is unheard of for a individual to be offered such a position with only a bachelor's degree, much less, just out of school. I hope to justify your confidence.

Sincerely,
John Millhouse

12 September 1997

Interoffice Memo:
To: President, FTI
From: John Millhouse, Orbiter Development Lab
Re: Concept

We have considered both reusable launchers and laser launch systems and have run into one serious problem with both—they only reach low Earth orbit (LEO). The reason that this is a problem is that LEO is *crowded*, especially equatorial and near-equatorial orbits. The danger of collision for stations, satellites, etc., that remain there is significant and growing larger. We need to get to a higher orbit.

What I propose is a hybrid system. A laser launch system would place the spacecraft in LEO, then an on-board rocket would transfer it to geosynchronous orbit.

Most of the preliminary work has already been done. It requires only your approval to go to final design specification.

15 September 1997

Interoffice Memo:
To: Millhouse, Orbiter Design
From: President, FTI
Re: Concept

Hybrid system? An excellent plan! Get on it right away. I want a design specification, budget, and timetable developed soonest. Draw people from other departments if you have to.

Good work.

December 18, 1997
Box 32785
New York, NY 10017

Charles Keinman
Chairman and CEO
Grumman Corporation
1111 Stewart Ave.
Bethpage, NY 11714-3580

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Dear Mr. Keinman:

Enclosed you will find the proposed budget for FutureTech Industries Phase II. You will note that Phase I is six months ahead of schedule and nearly a half million dollars under budget. As per your preemptive rights, we are offering you first refusal on 1.2 billion dollars of common stock.

We realize that this is an exceptional amount of capital. We are therefore willing to finance the purchase of the stock at 6 percent APR interest amortized over the five years of the Phase II schedule with the stock itself as security for the loan.

Sincerely,
Richard K. Schneider
President
FutureTech Industries, Inc.

December 18, 1997
Box 32785
New York, NY 10017

James D. Cunningham
President
Rockwell International, Inc.
Space Transportation Systems Division
12214 Lakewood Blvd
Downey, CA 90241

Dear Mr. Cunningham:

Enclosed you will find the proposed budget for FutureTech Industries Phase II. You will note that Phase I is six months ahead of schedule and nearly half a million dollars under budget. As per your preemptive rights, we are offering you first refusal on 1.6 billion dollars of common stock.

We realize that this is an exceptional amount of capital. we are therefore willing to finance the purchase of the stock at 6 percent APR interest amortized over the five years of the Phase II schedule with the stock itself as security for the loan.

Sincerely,
Richard K. Schneider
President
FutureTech Industries, Inc.

December 27, 1997
1111 Stewart Ave
Bethpage, NY 11714-3580

Richard K. Schneider
President
FutureTech Industries, Inc.
Box 32785
New York, NY 10017

Dear Mr. Schneider:

We are interested in continuing capitalization of FutureTech Industries. We, however, do not find your terms acceptable. We would, instead, like to purchase 240 million dollars of stock and an option for the remainder at a price of 31.5 million dollars. We also require a proviso to automatically extend the option additional years by paying 3 percent of the current market value of the included stock outstanding.

Sincerely,
Charles Keinman
Chairman and CEO
Grumman Corporation

January 2, 1998
Box 32785
New York, NY 10017

Charles Keinman
Chairman and CEO
Grumman Corporation
1111 Stewart Ave
Bethpage, NY 11714-3580

Dear Mr. Keinman:

Your proposal regarding a stock op-

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tion is perfectly acceptable with the further proviso that the option may only be extended if your company purchases 20 percent of the total shares offered by your preemptive rights each year at book value. We feel that this is necessary to prevent any cash flow problems.

Sincerely.
Richard K. Schneider
President
FutureTech Industries, Inc.

January 5, 1998
12214 Lakewood Blvd
Downey CA 90241

Richard K. Schneider
President
FutureTech Industries, Inc.
Box 32785
New York, NY 10017

Dear Mr. Schneider:

I have recently spoken to the board of directors. They are concerned about their investment. Spaceways, Inc. has already begun construction of their prototype and all you have produced is a design specification. Unless you can produce substantial reasons for our continuing investment, I have been instructed to withdraw from further funding.

Personally, I hope that you can answer their fears. I was an engineer before moving into management and I can see what you're trying to do. I also know what effect it will have on your other investors were we to pull out. I'd hate to see FutureTech fold over something as silly as this. Good luck. I'll be pulling for you at this end.

Sincerely,
James D. Cunningham
President
Rockwell International, Inc.
Space Transportation Systems Division

January 7, 1998
1111 Stewart Ave.
Bethpage, NY 11714-3580

Richard K. Schneider
President
FutureTech Industries, Inc.
Box 32785
New York, NY 10017

Dear Mr. Schneider:

We can fully understand your position and agree to your terms. Please have your finance department contact ours to arrange the details.

Sincerely,
Charles Keinman
Chairman and CEO
Grumman Corporation

January 12, 1998
Box 32785
New York, NY 10017

James D. Cunningham
President
Rockwell International, Inc.
Space Transportation Systems Division
12214 Lakewood Blvd
Downey, CA 90241

Dear Mr. Cunningham:

First of all, I appreciate your support. There are a number of factors that you might mention to the board: First, Spaceways Inc.'s project is so badly over budget and behind schedule that I tend to believe they had underbid, trusting their investors to cough up the necessary funds to cover the "bad luck." Second, their spacecraft has such a low payload capacity that it is useless for many of the more ambitious projects. They are using essentially the same de-

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sign as the old Mk I Shuttle and, since they found the same problems with LEO that we did, giving their craft the capability to reach higher orbits cost them dearly. The result is that there is little to choose from between them and *any* shuttle for smaller payloads and they are not a choice at all for larger ones. In fact, they are barely competitive with the Japanese shuttle. Don't get me wrong. Their ship is a marvelous accomplishment when one considers the budget with which they had to work, but as long as the government shuttles remain subsidized, I don't think there is much hope that Spaceways will see much use. They need a larger payload capacity.

On our part, our budget has been honest. Our design specification tells us what problems to look for and gives avenues to pursue for solutions. Our plan has sufficient flexibility to handle unexpected difficulties. When we complete development work three years from now, we will be able to place payloads in geosynchronous orbit at less cost than current systems place them in LEO.

You might also note that we are projecting a completion date nearly two years short of our original estimate. This has been the result of proper preliminary design.

I hope that this helps.

Sincerely,
Richard K. Schneider
President
FutureTech Industries, Inc.

January 20, 1998
12214 Lakewood Blvd
Downey, CA 90241

Richard K. Schneider
President
FutureTech Industries, Inc.
Box 32785
New York, NY 10017

Dear Mr. Schneider:

I tried. The board wouldn't budge. The best I could do was to get them to hold off for two weeks. Can you come out here and talk to them? Maybe you can accomplish what I could not.

Sincerely,
James D. Cunningham
President
Rockwell International, Inc.
Space Transportation Systems Division

January 27, 1998
Box 32785
New York, NY 10017

James D. Cunningham
President
Rockwell International, Inc.
Space Systems Transportation Division
12214 Lakewood Blvd
Downey, CA 90241

Dear Mr. Cunningham:

Thank you for your efforts. I will be arriving on the 1430 flight out of New York on January 30. If you would make an appointment for me with the board, I would very much appreciate it. I am sending this via Express Mail to be certain that you receive it in time.

Sincerely,
Richard K. Schneider
President
FutureTech Industries, Inc.

Transcript of the meeting between Richard K. Schneider and the Board of Directors of Rockwell International, Space Transportation Systems Division, Feb

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2, 1998.

Members Attending:

James Cunningham—President

Evelyn Wooster—Executive Vice President

Ryan M'Benga—Financial Vice President

Julia Harver—Personnel Manager

Terrance Hinman—Secretary

Attending by Invitation:

William Worthington—Chairman and CEO, Rockwell International, Inc.

Richard Schneider—President, FutureTech Industries, Inc.

Mr. Worthington, as ranking member of the parent company, held the chair.

Worthington: Mr. Schneider, it is our decision to sever ties with FutureTech Industries. Although we have allowed you to come and speak as a courtesy, our decision is firm.

Schneider: Thank you for the chance to speak. I do appreciate this opportunity you're giving me to plead my case.

M'Benga: Mr. Schneider, we have poured money into your company, when do we see a return on our investment?

Schnedier: (Hands out papers.) These contain a complete workup of our plans for the next five years. You may look them over at your leisure, but I will summarize here: We have completed our developmental work and finalized our design. I will remind you that we are six months ahead of schedule and half a million dollars under budget; the same budget you approved in initial financing. We are moving into the experimental portion of our program, primarily to develop the optics for the laser launch system and the focusing devices for projecting and aiming the beam through the atmosphere for long distances. This is expected to take about two years and to require 30 percent of our budget to that point. Simultaneously we will—

Harver: Excuse me, Mr. Schneider, but I don't understand this laser launch system. How does a laser launch spacecraft?

Schneider: Well, in an ordinary rocket, chemical reactions are used to produce a hot gas and this gas is used to propel the rocket. OK?

Harver: That I understand.

Schneider: In our laser launch system we use lasers to provide the energy that is provided by chemical reactions in ordinary rockets. The lasers heat the fuel, water in our case, to a high enough temperature that it becomes an excellent reaction fluid.

Harver: If it's that simple, why hasn't anybody done it before?

Schneider: There are a number of reasons—advances in laser power were needed. Plasma physics had to reach the point of comfortably handling the temperatures needed for really efficient rockets. Enough industry had to be based in space to make the capital expenditure worthwhile. The lasers have only recently been declassified by the Defense Department and the focusing systems they use on their missile defenses are still classified, so we have to replicate their research. Magnetic techniques in fusion research have given us the abilty to handle the superhot exhaust gasses. And the various space stations and industrial satellites in orbit have provided us with a customer base.

Harver: Mr. Worthington, don't you think—

Worthington: Mr. Schneider, if you

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will continue your presentation.

Schneider: Where was I? Oh, yes. While we are doing the experimentation into laser optics, we will begin construction of our launch facility. We already have contracts to purchase the land at Mauna Loa. It has perfect characteristics: ocean to the east in case of an abort and a fairly high mountain. It helps to have the laser on a tall mountain.

M'Benga: That's part of the problem, Mr. Schneider. The launch facility is to be located right on the edge of the Hawaii Volcanoes National Park. The permits required are a large portion of your budget. Wouldn't it be cheaper to place it, say, in the American Rockies? That would make it much cheaper and would have the additional benefit of being much more accessible as well.

Schneider: That's true. It would. On the other hand, we are using a brand new technology here. There are doubtless going to be problems, certainly a few crashes, before we've shaken all the bugs our of the system. I would much rather those crashes occur in the Pacific Ocean than in, say, Denver. Not only would there be lawsuits, litigation, and expenses for property damage, but there would be a huge loss of life. A crash would be a close equivalent to a major bombing. If you want to save a few pennies at that cost, I'll be happy to move it—

M'Benga: No, I don't think so. Your choice was better after all.

Worthington: If we could have an end to these interruptions, perhaps Mr. Schneider could conclude his talk?

Schneider: That's pretty much all I had to say, except to remind you of a few facts.

On December 6, 1928, a new company was founded. It was an aircraft company, called North American Aviation. At that time it was a holding company, until, in 1937, they built their first aircraft, an observation plane for the Army. It was a small accomplishment, but the start of something more. Soon after, a trainer for the army Air Force became their second project, the T-6. It became the standard trainer of World War II. It can be said that this plane, by training the pilots that flew over both Germany and the Pacific, won the war. On its heels came both the first medium bomber and the Mustang fighter. Everyone knows the Mustang, the most famous fighter of the war.

It was this company that built the X-15 rocket plane, the plane that first carried men to the edge of space and set speed records that remain unsurpassed.

Little money was made from the X-15, but the experience that North American Aviation, then renamed Rockwell International, gained gave it an edge that led to the Mk I Shuttle contract and major roles in the NASA space station.

Now you have a chance to repeat history. You may step forward, forging ahead with the new technology we are developing, or you may wait but lose out on the opportnity. Make no mistake, someone *will* develop the technology. If not FutureTech, to the profit of our investors, then the Japanese, or the Germans, or the Soviets.

That's where it stands. The choice . . . is yours.

Worthington: Thank you Mr. Schneider. We'll be in touch.

* * *

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February 4, 1998
12214 Lakewood Blvd
Downey, CA 90241

Richard K. Schneider
President
FutureTech Industries, Inc.
Box 32785
New York, NY 10017

Dear Mr. Schneider:

I was wrong. You should not have been a used car saleman. You should have been a politician, or an evangelist. I've never seen mere words so captivate the bean counters. You won over Ms. Harver and Mr. M'Benga, and I was able to sway Ms. Wooster. Together we controlled enough stock to override Worthington and Hinman.

In the wake of the success of the voting, I was able to push for and have passed a resolution to purchase your stock outright rather than to finance it. This should put you in a superior cash position. I hope that this buffers any unexpected problems that come along, and they *always* come along. Murphy's law reigns supreme.

Sincerely,
James D. Cunningham
President
Rockwell International, Inc.
Space Transportation Systems Division

16 June 2000

Interoffice Memo:
To: President, FTI
From: John Millhouse, Orbiter Development Lab
Re: Budget

Help! Although we're ahead of schedule, we're being eaten alive by costs. The problem seems to be that we're paying *engineers* to perform even the most routine tasks.

19 June 2000

Interoffice Memo:
To: Millhouse, Orbiter Development Lab
From: President, FTI
Re: Budget

I'm on it. Hold tight. We'll get that budget in line *without* cutting corners.

19 June 2000

Interoffice Memo:
To: Personnel
From: President, FTI
Re: New program

Locate which employees have teaching credentials. Arrange appointments with me for them through my secretary soonest.

3 July 2000

Interoffice Memo:
To: Legal and advertising
From: President, FTI
Re: New program

We are starting an apprenticeship program. Individuals of junior high school and high school age will receive three-month to one-year apprenticeships. Said individuals to receive room and board plus a small monetary allowance. Accredited tutors will be provided for academic subjects. Run it as a special boarding school if you have to. Also for each three months in the apprenticeship program we will offer a full tuition scholarship for one quarter or its equivalent. (Apprentices may remain in the program beyond the first year if they show merit.)

These apprentices will do much of the routine work in designs (bottle wash-

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ers). Prepare the necessary paperwork and have it routed to my office.

5 July 2000

Interoffice Memo:
To: President, FTI
From: Tom Kellinger, Legal
Re: Apprenticeships

Note: If we give special consideration to economically disadvantaged students, there is a federal program that will pay half the costs. Interested?

7 July 2000

Interoffice Memo:
To: Kellinger, Legal
From: President, FTI
Re: Apprenticeships

Very! Do it.

August 2, 2000
1432 Halstead Rd.
Akron, OH 44313

Dear Rick,

I'm writing because I don't know what else to do. I just got a look at Spaceways's patent for their orbital maneuvering system. There's a terrible problem with it. I checked with my friend in chemistry and he confirms it. Repeated exposure to vacuum will cause the plasticizers to leach out of their gaskets. Eventually they'll blow out. I tried to warn Spaceways about it, but they won't listen. I tried NASA and the FAA, but they don't have jurisdiction. *Nobody* has jurisdiction! I don't know what to do. That system's going to kill someone. It's worse than the old Mk I Shuttle boosters.

Please do something,
David

August 9, 2000
Box 32785
New York, NY 10017

Dear David,

Regarding the problem with Spaceways's orbital maneuvering system. I'll take care of it. Thank you for bringing it to my attention.

Your friend,
Rick

August 9, 2000
Box 32785
New York, NY 10017

M. L. Gardner
President and CEO
Spaceways, Inc.
Box 1734
Los Angeles, CA 90065

Dear Mr. Gardner:

It has come to our attention that there is a serious flaw with your orbital maneuvering system. The gaskets are incapable of withstanding repeated exposure to vacuum. I have checked with our engineering department and they have confirmed the flaw. In fact, we looked at the same system and discarded it some time back. In the interest of safety, we are willing to offer you our system as a replacement.

Sincerely,
Richard K. Schneider
President
FutureTech Industries, Inc.

August 17, 2000
Box 1734
Los Angeles, CA 90065

Richard K. Schneider
President
FutureTech Industries, Inc.
Box 32785

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New York, NY 10017
Stuff it, Schneider:

We beat you. My own engineering department assures me that there is no flaw. I think you're just trying to buy into our success. Well, it won't work. I'll see your company bankrupt.

M. L. Gardner
President and CEO
Spaceways, Inc.

August 24, 2000
Box 32785
New York, NY 10017

M. L. Gardner
President and CEO
Spaceways, Inc.
Box 1724
Los Angeles, CA 90065
Dear Mr. Gardner:

For God's sake, we'll *give* you the damn system! I'm trying to prevent someone from being killed here and you're yelping about corporate maneuvering. You know that none of the government systems can reach your orbits if something goes wrong. You're only building one prototype so there can be no rescue. Enclosed, there is a non-exclusive license for our own OMS. There are no royalties, no fees, no costs of any kind. Please use it.

Sincerely,
Richard K. Schneider
FutureTech Industries, Inc.

September 4, 2000
Box 1734
Los Angeles, CA 90065

Richard K. Schneider
President
FutureTech Industries, Inc.
Box 32785
New York, NY 10017
Schneider:

In case you're wondering, the enclosed shredded paper is your license. I don't want your help. I don't need your help. And I won't have your help.

Gardner,
Spaceways, Inc.

13 September 2000

Interoffice memo:
To: President, FTI
From: Millhouse, Orbiter Development Lab
Re: Paydirt!

We did it! Estimated cost of tooling 20 percent less than the Japanese Shuttle, cost of construction—30 percent less, costs for turnaround—80 percent less (!!!!!), mission lifetime—1000 missions. Fuel to LEO for the laser launcher is water, virtually free. LEO to GEO requires very little. We've hit the jackpot on this one, no doubt! Also, one of the bright boys in the apprenticeship program came up with an idea. With a slight modification, the orbiter can become a sub-orbital boost glider. We can offer intercontinental travel anywhere in the world in less than half an hour at *half* the cost of the Orient Express. Oh, if you're interested, we beat Spaceways's system by a considerable margin too. Did good?

14 September 2000

Interoffice memo:
To: Millouse, Development
From: President, FTI
Re: Paydirt
Did great.

Transcript: Deorbit and landing pro-

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cedures, Spaceways Flight 23. July 1, 2001

Shuttle Crew:

Commander _____ Boris Helmholz
Pilot _____ Roger Faraday
Mission Specialist Thomas Carmichael

Ground Crew:

Crew Chief _____ Brian Smithers
Tracking Controller ____ Simon Neville
Spectator _____ Miles L. Gardner

L-1:24:00

Helmholz: Control, this is Flight 23, ready for deorbit burn.

Smithers: Roger, Flight 23, stand by.

L-1:21:00

Smithers: Transmitting deorbit computer program, Flight 23.

Helmholz: Roger, Control. It looks good, out.

L-1:17:00

Smithers: Flight 23, this is Control. You are go for deorbit burn.

Helmholz: Roger, go for deorbit burn, out.

L-1:15:23

Helmholz: Control, this is Flight 23. Maneuver to burn attitude complete, over.

Smithers: Roger, out.

L-1:03:00

Helmholz: Control, this is Flight 23. We have aux power start, over.

Smithers: Roger, APU start, out.

L-1:02:00

Helmholz: Control, this is Flight 23. Engines are armed, over.

Smithers: Roger, engines armed, out.

L-1:00:15

Helmholz: Control, this is Flight 23. Countdown to burn ignition . . . five . . . four . . . three . . . two . . . one . . . ignition, over.

Smithers: Roger, ignition, out.

L-0:58:32

Faraday: Shit.

Helmholz: What's the problem?

Faraday: We're losing thrust.

Smithers: Flight 23, this is Control. Report status.

Helmholz: Yeah, I can feel it now.

Smithers: Flight 23, this is Control. Report status, over.

Helmholz: We're losing thrust up here, big time. Hold on a second . . . it's gone.

Smithers: Flight 23, this is Control. Report.

Helmholz: We've lost the engines. Stand by. Tom, can you see what happened?

Carmichael: One second . . . yeah, I can see it. There's a big vapor plume from just forward of the engine bay. We've blown something in the plumbing is my guess.

Helmholz: Control, did you get that?

Smithers: Affirmative, Flight 23.

Smithers: Mr. Neville, get a fix on Flight 23. Did they decelerate enough to reenter?

Neville: One moment. Negative, they're in an elliptical orbit. Apogee, 1600 km, perigee, 800 km.

Smithers: Mr. Gardner, we have a problem.

Gardner: I can see that. Get them down.

Smithers: Mr. Gardner, that may not be possible.

Gardner: I don't want excuses, I want them down.

Smithers: Mr. Gardner, may I remind you that neither the station nor the shuttle is designed for long periods in space. They have the life support capacity to survive three days at most. Then they die.

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Gardner: All right, do what you can. I'll handle the press.

July 1, 2001

UPI FLORIDA—Disaster struck today as Spaceways Inc.'s prototype shuttle suffered an engine malfunction while attempting deorbit from their recently completed space station, Spaceways I. No word is available on attempts to rescue the twenty men and women aboard the space station or the three men aboard the shuttle. When asked what may have caused the malfunction, Miles Gardner, President of Spaceways, Inc. replied, "No comment."

2 July 2001

Interoffice Memo: Rush
To: Operations
From: President, FTI
Re: First flight

Cancel previous flight plan. Top priority to rescuing the inhabitants of Spaceways I. Draw whatever you need from any and all departments.

3 July 2001

Interoffice Memo: Rush
To: President, FTI
From: Operations
Re: Rescue

We have the delta V to reach geosynchronous orbit. Spaceways I is in a 1,000 mile orbit, thus we have plenty of performance to spare. Computer simulation shows that if we time the launch right, we can rescue both Spaceways I and the Spaceways shuttle. Furthermore, we have the cargo capacity to bring down the shuttle intact, perhaps important in the legal battles that are sure to follow. Do it?

3 July 2001

Interoffice Memo: Rush Immediate
To: Operations
From: President, FTI
Re: Rescue

Of course do it!

Transcript: FTI Shuttle mission F-0101, July 4, 2001

Shuttle Crew:

Commander_____George Willard
Pilot_____Karen Gold
Mission Specialist_____ Thomas Banks

Ground Control Personnel:

Crew Chief_____Sheila Wright
Laser System Manager_ André Dubeque
Spectator_____Richard Schneider
Unidentified Voice 1
Unidentified Voice 2

T-1:30:00

Wright: F-0101, this is Mauna Loa, radio check, over.
Willard: Roger, read you five by, out.

T-1:20:00

Wright: F-0101, this is Mauna Loa. Ready for abort advisory check, over.
Willard: Roger, check is satisfactory, out.

T-1:10:00

Wright: F-0101, this is Mauna Loa. Side hatch is secure.
Willard: Roger, we copy, out.

T-1:05:00

Willard: Mauna Loa, this is F-0101. We show cabin pressure nominal, over.
Wright: Roger, out.

T-0:51:00

Willard: Mauna Loa, this is F-0101. Stable table alignment complete. We show 19° 10′ 30.32″ north by 155° 45′ 15.27″ west, over.
Wright: Roger, F-0101. Confirmed. Out.

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T-0:50:00

Willard: Mauna Loa, this is F-0101. Boiler control . . . on. Nitrogen supply . . . on.

Wright: Roger out.

T-0:32:00

Willard: Mauna Loa, this is F-0101. Backup flight systems check complete, over.

Wright: Roger, F-0101, out.

T-0:30:00

Wright: F-0101, this is Mauna Loa. Ground crew is secure, over.

Willard: Roger, out.

T-0:28:00

Willard: Mauna Loa, this is F-0101. Orbit transfer engines check complete . . . cabin vent complete, over.

Wright: Roger. F-0101. We confirm, out.

T-0:25:00

Willard: Mauna Loa, this is F-0101. Commander's voice check, over.

Wright: Roger, out.

Gold: Mauna Loa, this is the pilot. Voice check, over.

Wright: Roger, out.

T-0:20:00

Gold: Problem with number three, George.

T-0:20:00(Holding)

Willard: Did you get that, Mauna Loa?

Wright: Affirmative, F-0101. The flight plan is garbled. Stand by.

Willard: Standing by.

T-0:20:00(Holding)

Willard: Well, Karen?

Gold: The board shows green now. There must have been an uplink error.

Wright: Affirmative, F-0101. Resume countdown.

T-0:15:00

Wright: F-0101, this is Mauna Loa. We will conduct the abort check, over.

Willard: Roger . . . looks good, out.

T-0:12:00

Wright: F-0101, this is Mauna Loa. Stand by for laser test.

Willard: Roger, standing by.

T-0:11:32

Unidentified voice 1: Shit.

Background voices, garbled.

Dubeque: Problem, Sheila.

Wright: What is it, André?

Dubeque: Number four laser bank is down. We've blown a circuit breaker.

T-0:10:52(Holding)

Wright: Damn, how long to fix it?

Dubeque: Don't know. We have to find the cause first.

Wright: All right, get on it. F-0101, this is Mauna Loa. We have a problem. Holding at 10:52.

Willard: Mauna Loa, if we hold much longer, we'll miss that launch window.

Gold: We can launch with three banks.

Banks: I say go.

Wright: I'll remember that when this becomes a democracy. For now, though, the decision is mine. Holding at 10:52.

T-0:10:52(Holding)

Willard: Mauna Loa, we've got to restart that countdown.

Wright: The problem still has not been corrected. Continue to hold.

Willard: For God's sake, Sheila. If we miss this window, the people up there are going to die.

Wright: All right, F-0101, stand by. Get Mr. Schneider.

Unidentified voice 2: Yes, ma'am.

Schneider: You wanted me, Sheila?

Wright: Yes, sir. There's a problem here that calls for a policy decision that I don't have the authority to make.

Schneider: What's the problem?

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Wright: The number four laser bank is down. We can launch with three, but there's no safety margin. If anything fails during launch, I don't know if the shuttle can get down safely. The trouble is if we don't restart the countdown now, we'll lose the launch window and the next one will be too late.

Schneider: What do the shuttle crew say?

Wright: They want to continue.

Schneider: Then do so. My responsibility.

T-0:10:51

Wright: Yes, sir. OK, F-0101. Countdown continues at minus 10:49.

Willard: Thanks, Mauna Loa.

Wright: Good luck, F-0101.

T-0:09:00

Willard: Mauna Loa, this is F-0101. Event timer is started, over.

Wright: Roger, F-0101, out.

T-0:06:00

Wright: F-0101. This is Mauna Loa. Initiate aux power prestart procedure.

Willard: Roger, out.

T-0:05:00

Willard: Mauna Loa, this is F-0101. Aux power prestart complete. Powering up.

Wright: Roger, over.

Willard: Aux power looks good, over.

Wright: F-0101, you are on internal power, over.

Willard: Roger, out.

T-0:01:57

Wright: F-0101, this is Mauna Loa. Beginning fuel top-off procedure.

Willard: Roger, out.

T-0:00:25

Wright: F-0101, this is Mauna Loa. All systems are go. You are on your onboard computer, over.

Willard: Roger, out.

T-0:00:05

Wright: Five . . . four . . . laser ignition . . . Two . . . One . . . Zero . . . F-0101, we have lift-off.

Background noise, cheering.

T+0:00:05.5

Wright: The launch tower has been cleared. All lasers look good.

T+0:00:07

Wright: Institute roll maneuver.

T+0:00:14

Wright: Roll maneuver complete, F-0101, you look good.

T+0:00:44

Willard: Mauna Loa, this is F-0101. Throttle back main engines. We are past the crisis point.

Wright: Roger, out.

Schneider: What did that mean?

Wright: Please, sir. I'm very busy.

Dubeque: Mr. Schneider, what they mean is that now they could run on two lasers if one should fail. They're out of danger.

Unidentified voice 1: André, I've found the problem. Four is back on line.

Dubeque: Now you tell me.

T+0:01:06

Willard: Mauna Loa, this is F-0101, max dynamic pressure, over.

Wright: Roger, F-0101, out.

T+0:07:40

Wright: F-0101, this is Mauna Loa. Throttle down, over.

Willard: Roger, out.

T+0:12:24

Willard: Mauna Loa, this is F-0101. We are ready to change over, over.

Wright: Roger, F-0101. Laser shutdown in five . . . four . . . three . . . two . . . one . . . zero. Lasers are off. You are on your own.

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Willard: Roger, Mauna Loa. We have orbit.

Crowd noises, unintelligible, cheering.

T+0:45:58

Wright: F-0101, this is Mauna Loa. Coming up on orbit transfer burn over.

Willard: Roger, Mauna Loa. Orbit transfer.

T+1:45:21

Willard: Mauna Loa, this is F-0101, we have completed orbit transfer. We have radar contact with Spaceways I.

Wright: Roger, F-0101. Contact confirmed. Begin docking procedure.

T+2:20:17

Willard: We've got them, Mauna Loa. We've got twenty people stacked like cordwood in the lower deck, but we've got them.

Wright: Good work, F-0101. Stand by for shuttle rendezvous data, over.

Willard: Standing by, Mauna Loa. Let's go find that stray shuttle.

Wright: F-0101, please adhere to communications protocol. Transmitting orbit transfer program now, over.

July 4, 2001

UPI HAWAII—The first FTI shuttle was launched today from the Mauna Loa catapult in an effort to rescue the personnel in Spaceways I and in the Spaceways shuttle. The takeoff went as planned. Spokesmen for FTI said that the laser launch system performed flawlessly.

July 7, 2001

UPI HAWAII—FutureTech Industries shuttle landed today after their successful rescue of the personnel of Spaceways I and the Spaceways shuttle. After a brief quarrel over jurisdiction, the National Transportation Safety Board impounded the Spaceways shuttle pending an investigation into the cause of the accident.

August 3, 2001

UPI LOS ANGELES—The National Transportation Safety Board released their findings today regarding the Spaceways shuttle accident. It found that the accident was the result of a preventable design flaw and that Spaceways had had warning of the risk of failure. Several civil suits were immediately filed against Spaceways, Inc. and there has been some question whether criminal charges may be filed against the directors.

September 12, 2001

The *Wall Street Journal*: Immediately in the wake of the financial disasters suffered by Spaceways, Inc., FutureTech Industries, Inc. purchased controlling shares of the company. There has been some question as to the reason behind this move as Spaceways is considered to be an extremely poor investment.

12 September 2001

Interoffice Memo:

To: Gardner, President, Spaceways, Inc., a division of FutureTech Industries, Inc.

From: Schneider, President, FTI

Re: Job security

You're fired. No reference. ■

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CLARION '91

The 24th Clarion Workshop in Science Fiction and Fantasy Writing will be sponsored by Lyman Briggs School at Michigan State University from June 23 to August 3, 1991.

Clarion is the oldest and most successful writing workshop in the science fiction and fantasy field. Over a third of its graduates have since published, among them Ed Bryant, Lucius Shepard, Vonda McIntyre, Michael Talbot, George Alec Effinger, Kim Stanley Robinson, and James Patrick Kelly, to name a few.

Writers-in-Residence for Clarion '91 will be Tim Powers, Karen Fowler, Ellen Kushner, Tom Disch, Kate Wilhelm, and Damon Knight. Editors-in-residence, on two Saturdays, will be Gardner Dozois and Gordon Van Gelder.

Members of the Clarion Workshop enjoy borrowing privileges at the (over 3,000,000 volumes) MSU Library, which also includes previous Clarion manuscripts, as well as the Voice Library and the Russell B. Nye Popular Culture Collection.

"Clarion is the literary equivalent to boot camp," says Tom Disch.

For application forms (application deadline is MONDAY, APRIL 15, 1991), or more information, contact:

David E. Wright, Director, Clarion '91
% Mary Sheridan
Lyman Briggs School
E-28 Holmes Hall
Michigan State University
East Lansing, MI 48824-1107
(517) 353-6486

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The Alternate View

QUANTUM TIME TRAVEL

John G. Cramer

The territory of time travel has, from the days of H. G. Wells to the mid-1980s, been the exclusive province of writers of science fiction and fantasy. SF critics have even argued that time travel stories are so scientifically unlikely that they should be considered fantasy, not science fiction.

In the last few years, however, a few theoretical physicists have been muscling in on the time travel game. The first assault was mounted by a group of general relativity theorists led by Kip Thorne of CalTech. Thorne's group demonstrated how space-time wormholes could be stabilized and used for trans-time communication and time travel. (See my Alternate View columns in the June '89 and May '90 issues of *Analog* for references and discussions of this work.) The present column describes the latest physics foray into the time travel business, which has come from the direction of quantum mechanics.

Yakir Aharonov and his group at the University of South Carolina have for a number of years been "testing the envelope" of quantum mechanics. Their work has involved probing and poking at the foundations of orthodox quantum mechanics in search of weaknesses, soft spots, and unexpected predictions. The latest of these is contained in a paper entitled "Superposition of Time Evolutions of a Quantum System and a Quantum Time Translation Machine" by Y. Aharonov, J. Ananadan, S. Popescu, and L. Vaidman (AAPV) that was published in the June 18, 1990 issue of *Physical Review Letters*. In essence, the AAPV paper describes how an aspect of quantum mechanics called *state superposition* can be used to translate objects inside a closed and isolated system into the future or the past. The paper, in other words, describes how, in theory, to build a quantum mechanical time machine.

To understand what Prof. Aharonov and his colleagues are proposing, we have to delve a bit into quantum mechanical superposition. To take a simple example, consider a half-silvered mirror. This is a piece of glass that has had just enough reflective material so that exactly half the light striking it at 45° incidence goes straight through the glass and the other half bounces from the reflective surface at a right angle. If a single photon of light encounters this half-silvered mirror, there is a 50% chance that it will be transmitted (pass through) and a 50% chance that it will be reflected.

One would think that the photon must do one thing or the other, but quantum mechanics tells us that it can do *both*. This can be verified experimentally. If we provide some extra mirrors to make two paths so that, after travelling some distance, a photon that was transmitted comes back to the same path as a photon that was reflected, we can observe

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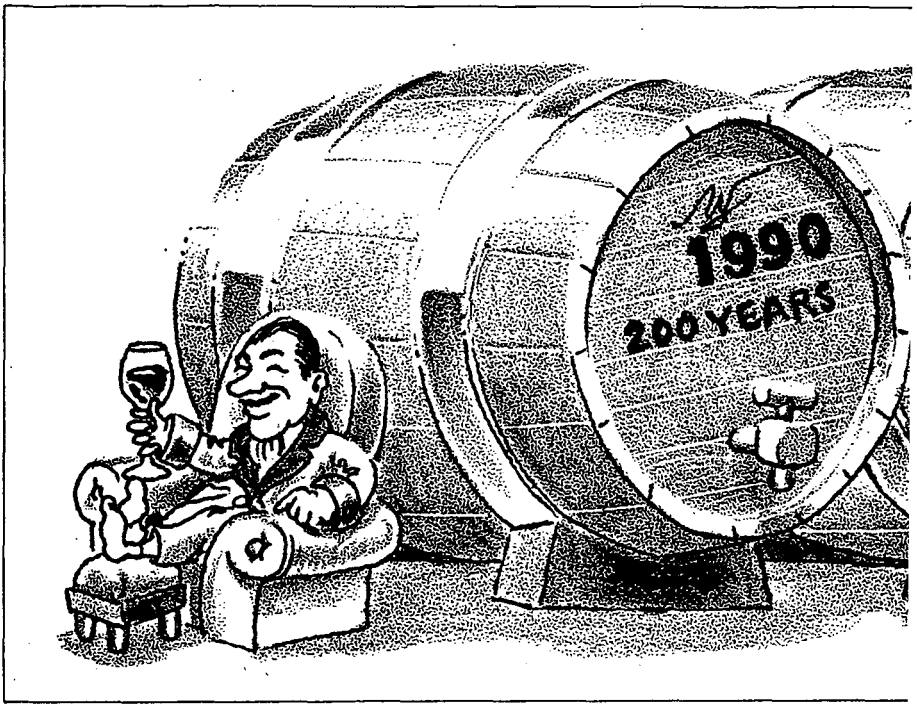

"quantum interference." The quantum mechanical wave describing the transmitted photon adds or subtracts from the wave for the reflected photon. If they subtract completely, the photon waves on the two paths cancel each other and no photons can be observed at the exit. If they add, the photons waves on the two paths help each other and can be observed. The two quantum states of the particle, "photon reflected" and "photon transmitted," are superimposed, with definite observable consequences. Quantum superposition is not limited to photons, which are somewhat special because they have no rest mass. It works equally well for massive particles and has been demonstrated using very slow neutrons, for example.

The mathematics of state superposition is unusual because quantum mechanics describes each state function as a complex variable that has a real part and an "imaginary" part (that behaves like the square root of -1). Each state has its own quantum mechanical "phase," the angle in the complex plane that its complex state function makes with the real number axis. The result of superimposing several states is determined by the quantum phases of the states. Some combinations of phases produce cancellation while others produce reinforcement.

The point of departure of the AAPV calculation from standard quantum me-

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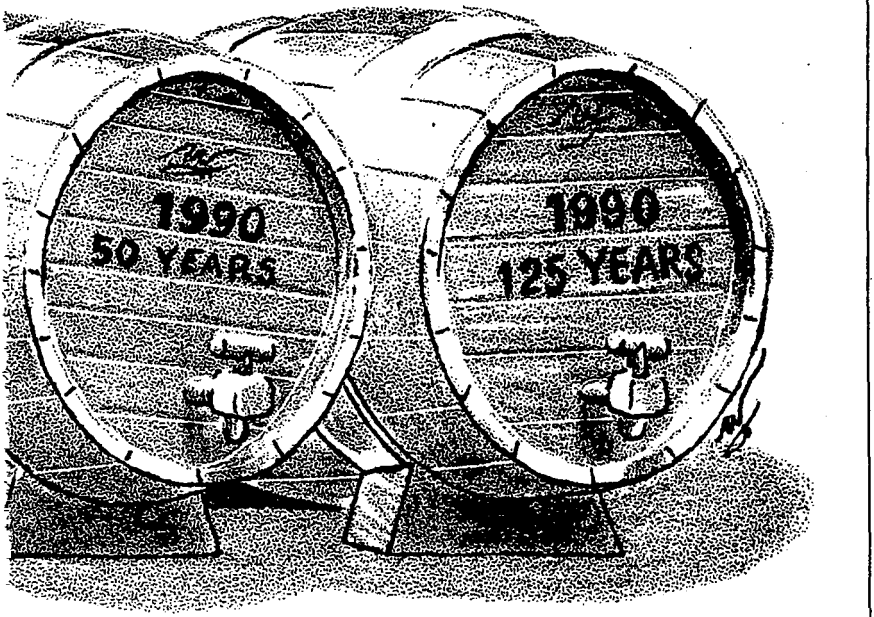
Illustration © 1991 by William R. Warren, Jr.



chanics is that it applies the principle of superposition to the *time evolutions* of a group of similar quantum states. This is not normally done in quantum mechanics, but it should be OK. It seems to be consistent with both the formalism of the theory and its usual interpretation, provided the states are isolated from measurement and outside interaction while evolving.

The application of superposition in this way, however, has unexpected and surprising consequences. Superposition can be considered the quantum mechanical form of averaging. Common sense tells us that when several values are averaged, the resulting average value must fall within the range of variations of the averaged values. AAPV, however, demonstrate that in superimposing a group of carefully prepared time-evolving states, they can produce a measured result that is far larger (or smaller) than the value that would have resulted from any of the states taken separately. This is a consequence of the fact that in quantum mechanics the "averaged" states are *complex* (real plus imaginary) space-time functions with *complex* weighting factors (not real functions with real weighting factors).

The AAPV paper illustrates this point with an example. They consider a superposition of a number of time-evolving states that differ from one another because of the size of the force that is

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acting to produce the change with time. The authors show that the effective force which results from the superposition of a set of time-evolving states may occasionally, under the right conditions, be far larger than any of the individual forces acting within the individual states. If ten thousand such states are superimposed, a force amplication of 100 is in principle possible through this process. The down side of the procedure, however, is that with the superposition of ten thousand identical systems, only one of these experiences this amplified force. Or, to put it another way, the 100-fold amplified force is observed only about once in 10,000 tries. This makes the effect observable, at least in principle, but it may not be particularly useful as a force amplifier.

The AAPV paper goes on to consider the application of this new quantum principle to time translation. The states they consider evolve with different elapsed times due to the time dilation effects of a gravitational field in general relativity. They arrange each superimposed system within a hollow massive shell with a quantum-uncertain radius, so that it experiences time dilation but no other gravitational effects (acceleration, tidal forces, etc.). They show that the superposition of a group of these time-evolving systems can result in a net time displacement which is quite different (positive or negative) from the elapsed time experienced by the external observer of the system. Thus, the system inside the shell had been translated forward or backward in time with respect to the observer.

The AAPV authors are careful to point out that the gravitation time translation device which they describe is a thought experiment only and is not feasible in today's physics laboratory. They also emphasize the probabilistic aspect of the time translation. Since the weightings that produce a large time translation occur only rarely and at random, they point out that "for any significantly long time journey in time the probability to obtain this outcome is extremely small."

For SF readers and writers, the question raised by this new result of quantum mechanics is the relation between the AAPV "time translation machine" and the familiar "time machines" and other devices of SF literature. It is not, for several reasons, a conventional SF time machine. The AAPV machine cannot be used to materialize a traveller or a message in some arbitrary point in the past or the future. What it does is modify the way a system within the machine experiences the passage of time. We could place a system in the AAPV machine, run it, and with some probability remove a system that has experienced a large positive time displacement. This could speed up the decay of a long-lived radioactive source from many years to a few seconds, suggesting a radical new way of dealing with radioactive waste. A barrel of wine or scotch might also be "aged" to increase its value and quality.

If we could select for zero time displacement, this would in effect produce a "stasis field" of the kind Larry Niven has used in his fiction. We could freeze the internal system with no time change for the period it was isolated, while time in the external world moved forward at

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the usual rate.

But perhaps the most interesting use of the AAPV machine would be to produce negative time displacements. It is not difficult to advance the time evolution of a system if we are patient. We have only to wait while it evolves or ages. But reversing its time evolution is not within our capabilities. The second law of thermodynamics, the inexorable increase in the entropy of a system with time, prevents such reversals. Yet the AAPV machine appears to offer the possibility of doing just that. A system, placed in an AAPV machine selected for negative time displacement, would evolve in reverse and grow younger. An aged experimental mouse, placed in a negative time displacement AAPV device, should grow younger. A clock should run backwards. A dead mouse (or person) might even be resurrected.

Another possibility worth considering is backwards-in-time communication. Communicating forward in time is no real problem. Office file cabinets are full of forward-in-time communications. But backward-in-time communication, or foreseeing the future, is something that we don't know how to do (except in the *National Enquirer*). But suppose that we use a large number of very small identical systems which are capable of containing an encoded message in their structure. Chain-like protein molecules would serve for this purpose. We encode them with a blank message, place them in the AAPV machine, and set it to select for large positive (future) time displacement. After operation on all the systems, we scan them and then place them in cold storage for a time, after which we systematically modify all of them to contain an encoded message to be sent to the past. Most of the systems have not undergone any change in the machine. But a few have undergone a large positive time displacement. These few should contain the future message *before* it was encoded into the group, and could be decoded in the past, before the systems were changed. Thus, a message might be sent to the past using this peculiar aspect of quantum mechanics.

Can the AAPV effect really be demonstrated in the laboratory? Can it be used to freeze, advance, and reverse time? Can it raise the dead? Can it be used to communicate with the past? I would have to say that I'm not sure. The AAPV paper is very new, and it has not been completely subjected to the full scrutiny and criticism of the physics community. There may be holes in the logic of the paper or additional effects that must be considered in stating the implications of its mathematics.

What is clear is that its implications are quite remarkable. The AAPV work serves to remind us once again of the intrinsic weirdness of quantum mechanics, and shows us that there are aspects of its weirdness that we do not yet fully understand or appreciate. ■

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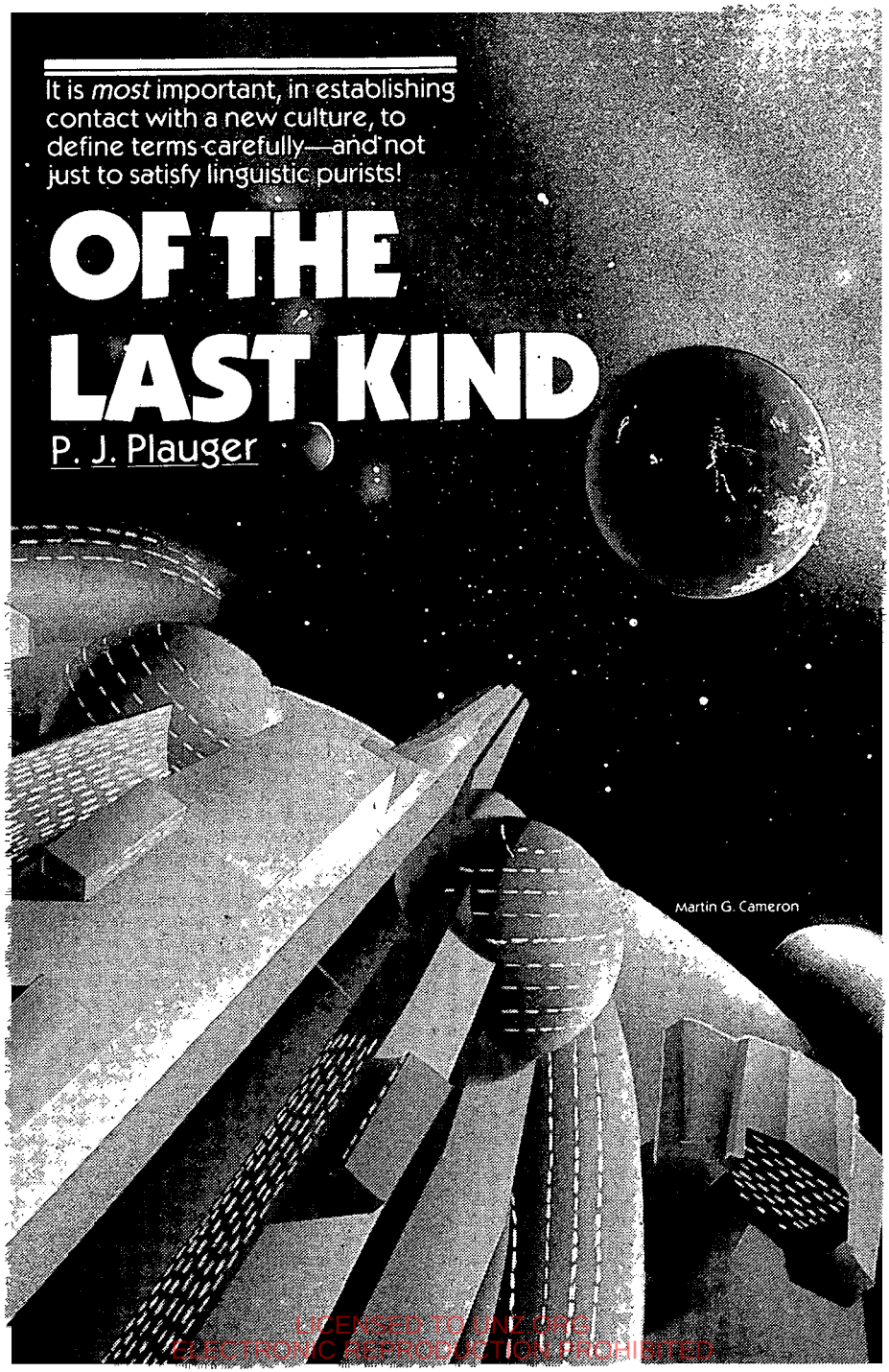
It is *most* important, in establishing contact with a new culture, to define terms carefully—and not just to satisfy linguistic purists!

OF THE LAST KIND

P. J. Plauger



Martin G. Cameron

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"But it just ain't fair!"

John Wellington Parkinson whined into the microphone of his CB transceiver with the practiced whine of a thirteen-year-old misfit. He was not getting his way.

"Explain 'fair,' in this context," the singsong voice came back at him after the customary delay.

John Wellington sniveled, considered terminating the conversation early. The Galactic Overlords always seemed to be more agreeable after a spell of the silent treatment. Unfortunately, he lacked the patience to use that tactic very often.

"Jerry Markleston goes for rides on flying saucers," he blurted out. There, he'd said it. So much for the careful line of reasoning he'd rehearsed all afternoon.

Jerry Markleston was his pen pal from Boulder, Colorado, who always seemed to be able to get one up on John Wellington. When the latter got a catcher's mitt for Christmas, Jerry Markleston talked his dad into a complete baseball uniform. When John Wellington established contact with the Galactic Overlords, Jerry Markleston was quickly doing business with the local UFOs.

Only Jerry Markleston got to fly around the Moon. Twice. And all John Wellington ever got to do was talk with his stuffy extraterrestrials.

"You know our policy concerning contact with humans," the answer came back after a satisfactorily protracted pause. He had them scared again. Maybe this time they would knuckle under.

"Yaah, I know," his voice dripping scorn. "Maybe I should sign a treaty with Jerry Markleston."

That would scare them good. So far as the Galactic Overlords knew, John Wellington was Emperor of the Pacific Hemisphere, ruling from his palatial estate just outside Honolulu. Jerry Markleston, on the other hand, was the evil Prime Minister who held sway over the shaky Eastern Alliance of Nations, otherwise known as the Commie Ratfinks.

The thought of a united Earth doing business with the sort of riffraff who roamed the stars making illicit contact with young civilizations—that very thought seemed to curdle the green slime that coursed through the veins of the Overlords.

John Wellington didn't know for a certainty that the Galactic Overlords had green slime instead of blood, but he liked to think they did. Just as he liked to think of them as the Galactic Overlords, even though they had a much humbler term for themselves. It made him feel more important.

Still no answer from the transceiver. There must be an intense debate going on at the other end. That was all to the good. John Wellington admired his wall-to-ceiling collection of baseball cards and Star Trek memorabilia. He looked out the small square of window above the humming air conditioner at the eaves of the Dawson house next door. He was blind to the rich blue of the tropical sky, to the lush palms framing the view, to the shelves of gadgets bought for him by adoring parents. None of that mattered to an unhappy adolescent.

The CB transceiver would have been relegated to those selfsame overloaded

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shelves weeks ago, had it not been for a peculiar flaw. Somewhere in Tokyo lived a Sony research chemist who had falsified some lab results when he couldn't explain the anomalous properties of a new semiconductor doping. He had missed out on a Nobel Prize. Somewhere in nearby Yokohama lived a quality control engineer who had been watching a passing fanny when John Wellington's CB exhibited its peculiar properties under test. The engineer had scored that night, but missed out on becoming a billionaire.

Now John Wellington was the proud and sole owner of the Earth's only interstellar hyperskip jump transceiver, or whatever you call a device that ties granny knots in Maxwell's laws. For five weeks now he had been educating the Galactic Overlords in the peculiarities of human civilization, and doing his level best to con them into a joyride.

"We have been considering," the radio suddenly sang out, "and wish to advise you that it would be extremely unsafe for you to deal with those who have established contact with Jerry Markleston."

John Wellington counted to ten, thumbed the transmit.

"Yeah, maybe, but they seem to be more cooperative than you've been."

"We merely wished to advise you. If you insist on a visit from us, however, we will oblige."

"Hot dawg!" John Wellington cried out, but not to a live mike. He would go around the Moon three times. And make them land him on Venus as well. A part of his mind began drafting his next letter to Jerry Markleston.

"We must warn you," the singsong continued, "that our ship is quite large. Our engineers must confer with you on preparations for our arrival."

John Wellington's dad was a 747 pilot, so John Wellington knew what the Overlords meant. Try to put one of those big babies down in a jerkwater airport and Goodnight Nurse. John Wellington subconsciously mimicked his father's pedantic nod as he mouthed that most favorite of phrases.

"Don't worry," he said into the microphone with easy confidence, "we're right next door to one of the biggest landing fields in the Pacific. We can deal with you."

A sly thought stole into his mind.

"But you may have some problems with the Commies, so be prepared for some interference on your way in."

It is a tribute to John Wellington's groundwork that this pronouncement was accepted without comment. In case you can't accept that, and in case you can't accept the premise that a thirteen-year-old could do business with a superior civilization, read any transcript of the United Nations Security Council. Large nations, at the best of times, behave with the emotional maturity of teenage boys.

"Very well," the Overlords replied. "We are approaching now and will be arriving in three days. Meanwhile, you promised to explain 'nitro burning funny cars,' 'female midget tag team grudge return match,' and 'peace with honor.' "

The Overlords landed, as promised, but not quite as expected. Since their ship was approximately one-sixth the size of the Moon, it would be more accurate to say they docked. The US Air Force did its level best to stop them, as

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did the Russians, the Chinese, and the Israelis. But the Overlords hardly noticed.

John Wellington was one of the first killed, of course. His body was sucked up by the tremendous gravitational forces that wracked Oahu, then fried in the spouting lava that followed. As for Jerry Markleston, he never saw the gloating letter that was washed out of a Los Angeles postal sorting station. The same tidal wave crested the Rockies an hour or so later and destroyed Boulder, Colorado in seconds. ■

IN TIMES TO COME

● No matter how legitimate the concerns and goals of any movement, it will develop a fringe of followers who carry things to, shall we say, odd extremes. Consider, for example, the self-styled "environmentalists" protesting the impending terraforming of Mars in "Intervention at Hellas," Daniel Hatch's cover novelette for May. (This one is *not* part of the author's "Asgard" series!) A rational debater might point out that Mars as portrayed in the beginning of Hatch's story has no ecosystem to preserve, but that doesn't stop the protesters who use such time-honored emotion-grabbing tactics as planting themselves squarely under the huge chunks of ice whose carefully planned impacts will start the transformation. Which creates something of a problem for those behind the project. . . . The title, by the way, may not mean quite what you think; and the cover is by David Hardy.

By the purest and most innocent of coincidences, the fact article is Jeff Hecht's "Global Catastrophes and Mass Extinctions," an updated look at the role such impacts (only unplanned) may have played in Earth's past—and why we should plan *not* to have them in our future! The issue will also feature Part II of Harry Turtledove's serial *The Great Unknown,* and assorted fiction by such writers as Grey Rollins and some promising newcomers.

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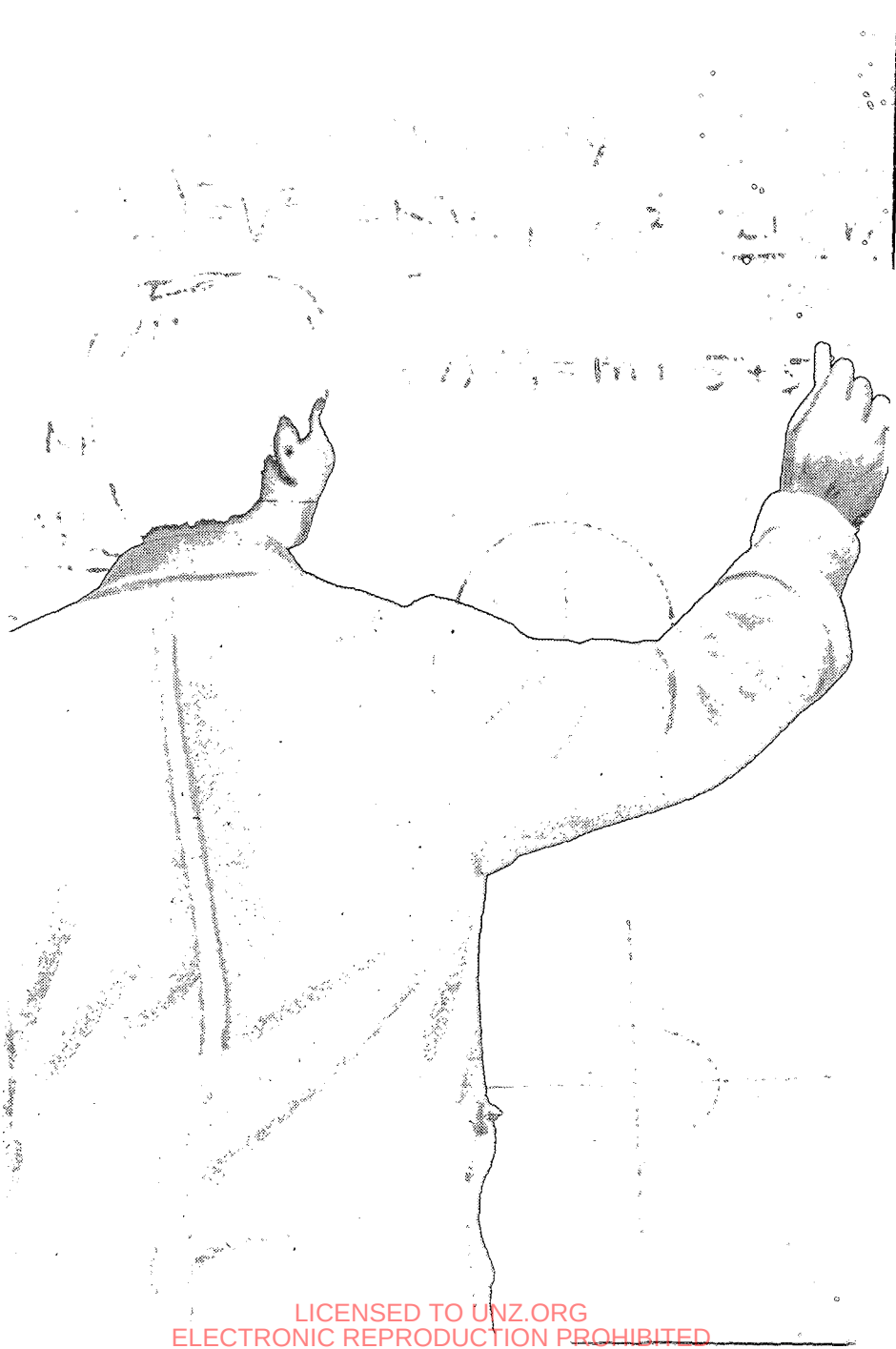

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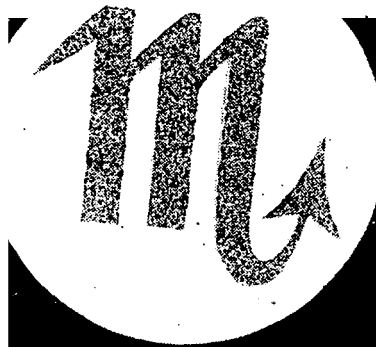
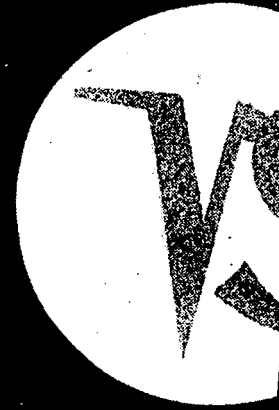


Forensics, like any field, develops its own principles of operation. But those are based on existing knowledge, and when that's changing very fast . . .

A MOST NGULAR MURDER

John Dalmas



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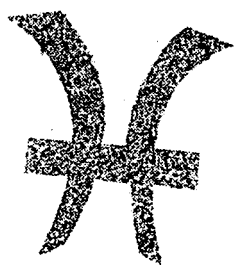

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My name is Martti Seppanen, and I work for Prudential Investigations and Security, Inc. I knew an assignment was coming up because Carlos looked in on me and told me to stick around. I'd had nothing much to do for a day and a half—since I'd finished rounding up the collusion evidence against Funsch, Carillo, & Wallace. So I stood there in my two-by-four office—three by three meters, actually—looking westward over the L.A. Basin toward the high rises of lower Wilshire. While drilling Spanish.

I don't mind days like that, actually. I can get into studying and drills. But there was that nagging worry that if business stayed slow for too long, Joe might have to lay people off. Even me. Times like that you can wonder whether it had been a good idea when the boss leased the eleventh floor in this high rent high-rise. Of course, the old building got sold out from under him and knocked down. The old buildings are disappearing.

Besides, when I don't have a case, I get the munchies worse than usual, and I gain weight too easily.

So I liked the prospect of an assignment. Meanwhile I kept drilling, using a Q&A—question and answer—program on intermediate Spanish. The computer would ask a question in fairly simple Spanish, and I'd answer it. Or it would tell me to discuss some simple thing. Then it would critique my diction, grammar, and pronunciation, and we'd repeat it until the program was satisfied with my improvement.

⟨⟨¿Dónde guarda ud. los documentos financiales?⟩⟩ the computer asked me. ("Where do you keep your financial records?") The questions were by a lieutenant on the LAPD, and the voice was his, too; the program is part of the department's language training.

⟨⟨Debajo de la bañadera⟩⟩ I answered, ⟨⟨donde nadie los buscaría.⟩⟩ ("Under the bathtub, where no one would ever look for them.") You do enough of those drills, you learn what the program'll accept. Also you're apt to get silly.

That's where things stood when Carlos opened my door again. "Come in my office," he said. "We've got something for you."

"We" meant himself and Joe Keneely; Joe being the principal shareholder and chief executive officer of Prudential Investigations and Security. Joe also holds Director of Investigations from above. And the "something" would be a contract. Carlos Katagawa is the senior investigator, and deputy director as needed. I was Carlos's protégé, I guess you would say, top of the list of junior investigators with Prudential.

I followed him down the hall. His office was big enough that he could hold a small conference in it without people sitting in each other's laps. He sat down behind his desk, and I took the chair across from him. Fingering his computer, he turned the wall screen on. A picture took shape and stopped; it showed Keneely's office, with Joe and Carlos and some guy I'd never seen before.

"The client is Donald C. Pasco," Carlos said, "all the way down from Sacramento." He said it as if it was less than a thrill. I'd heard of Pasco but never seen him. He was director of the Anti-

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Fraud Division of the California Department of Commerce, and had a reputation as an aye-aitch. Carlos obviously didn't like him, and Carlos and I tend to see a lot of things alike.

"Joe just signed a contract with him," Carlos went on. "I'll run you a couple of disks and you'll know as much about it as we do."

The picture came to life, and I was watching their conference. Actually I was watching Pasco bitch and snarl. About three weeks earlier, an astronomer named Arthur Ashkenazi had read a paper to the California Section of the Astronomical Society of America, at the section's annual meeting. The paper was what had gotten Pasco upset. Pasco didn't have much presence at all, but he had rank and plenty of venom. After playing back the meeting with Pasco, Carlos ran Ashkenazi's talk for me. I'd been aware of it before, just barely. It had been written up in the papers, but I hadn't read it. I read fast, but the *L.A. Times* is thick, and Ashkenazi's talk hadn't had any significance for me.

Now, watching him deliver the talk, it turned out to be pretty interesting. It didn't offend me at all, but it did Ashkenazi's audience. He'd hardly gotten well underway when people started to leave. One after another got up and walked out. After the first few, they tended to stalk out.

About halfway through his talk and three-quarters of the way through his audience, one of them got up and started shouting that Ashkenazi should be thrown out. That what he was spieling was astrology, not astronomy. Another man stood up then, apparently some sort of officer of the meeting, and yelled at the guy that he'd either have to sit down and be quiet, or leave. The guy left, madder than hell, and most of the remaining audience followed him out in a bunch. Ashkenazi finished to a dozen listeners, probably mostly reporters, and didn't seem upset at the exodus. I suppose he wasn't surprised.

Basically Ashkenazi was reporting that he'd run correlations of events of one sort or another against the positions of stars and planets. Which did amount to astrology, as far as I could see. And while I'm no statistical analyst, I do know that the kind of correlations he was claiming aren't the sort of thing you get by chance.

He'd done it the hard way, too, or so it seemed. He hadn't picked a scattering of historical events that fitted his purpose. Over a period of almost thirty years he'd predicted events, supposedly from the positions of stars and planets, and published them in advance in various newsletters and magazines put out by different astrology groups, New Age groups, and groups into psychic phenomena. And most of his predictions came out as forecasts. Predictions like droughts, major political shifts, uprisings, big stock market swings, depositions of heads of states, several major deaths. . . . If the publications were real. If he hadn't faked them. In 1994, he'd even predicted that a then-unknown source of electric power would be released in 1997, that would change the world. And "from the midwest," at that! Haugen's geogravitic power converter. That was uncanny.

I could see why a bunch of astronomers might get spooky about stuff like that, but why was Pasco so upset? And

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even if the stuff was phony, it wasn't illegal and it wasn't commerce. Which was what the Anti-Fraud Division was supposed to be concerned with—criminal fraud in commerce, in business. This was something the astronomers could take care of themselves if they wanted to, by kicking Ashkenazi out of their society. Which in fact they had, for misrepresenting his talk to the program committee.

From the record of the meeting with Pasco, I could see that Joe felt uncomfortable with the job, the same as I did. Because what Pasco wanted was a fishing expedition at the taxpayers' expense. We were supposed to investigate every damned thing about Ashkenazi. Or everything but his finances; the California Commerce Department's Audit Division would do that. To quote Pasco: "Find something discreditable about this Ashkenazi, preferably something criminal."

It wasn't the sort of thing Joe Keneely liked, and I asked how come he'd accepted the contract. Carlos spelled it out for me: "A fair amount of our business comes from Commerce—we're their number one contractor in southern California—and competition's picking up. Joe doesn't want them turning to somebody else."

I could have turned the assignment down. Joe's used to me being a hardhead, and I'd earned enough points with him and Carlos that they wouldn't have been too mad at me. But somehow I said OK, I'd do it.

Then I went back to my office, sat down at my computer, accessed the L.A. Library, and called up what the media—print and TV—had had to say about Ashkenazi's talk. The California press had had people at the astronomers' meeting, of course, stringers and junior staff, and since the news had been dull for a while, they'd played up the Ashkenazi flap pretty big. Mostly somewhat tongue in cheek, but pretty much without ridiculing it. The syndicates had gotten hold of it then and featured it nationwide. Then *Time* magazine had picked it up and done a feature on it, treating it straight, and Ashkenazi had made the talk show circuit on the strength of it all.

All of which had burned Pasco up, and he was using his position, and us, to try to punish Ashkenazi. That's what it amounted to. While Pasco had no reason to suspect the astronomer of anything illegal, he was willing to exercise his authority and spend taxpayers' money on the off chance of finding something. And somehow I'd agreed to help him.

Usually you start a case with evidence of a crime, and that gives you something to orient on. This one was different. And since it was almost five o'clock, I found it easy to kill a few minutes and leave the office promptly at quitting time. It wasn't a workout day, and I had a date that evening, so I went straight home, showered, re-shaved, changed, and picked up Tuuli. We took my car—hers is quite a lot nicer, but she's considerate about things like that—and drove to Mr. Ethel's, on North La Cienega. Mr. Ethel's specializes in low-cal meals, and the quality of the food makes up for the strange waiters.

Tuuli doesn't worry about calories; they're my problem. She's the same age as me, thirty, but only five feet tall and

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fine-boned. She probably doesn't weigh eighty-five pounds. Which is 40 percent of what I weigh, and about a third of that I weigh sometimes. She's the only Lapp immigrant I know of—actually half-Lapp. Her father's a Finn, same as mine was. Born in the little mining town of Tuollivaara, in Swedish Lapland, she grew up partly there, and partly on a backwoods farm near Koivujoki, in Finnish Lapland. Came to America when she turned eighteen. She says, and she doesn't lie, that she decided to emigrate when someone told her that in California, women could be shamans and all the shamans were rich.

She's been psychic, she says, since she was a little kid, and from what I've seen, it's easy to believe. Plus her great-great-grandfather had been one of the last Lapp shamans—the state church pretty much shut shamanism down in Sweden a hundred and fifty years ago—and the lore got passed down to Tuuli through her mother, even though they were females.

How I got to know her is, she sometimes consults for police agencies and private investigation firms in greater Los Angeles. The police don't like to acknowledge it—they think it's bad for their image—and she doesn't publicize it. She just deposits their checks, so to speak—registers their electronic credit transfers on her bank account. That's how it's usually done in the big city.

Of course, she built her reputation through the rich and famous, and most of her income is from wealthy private clients. There's a lot of rich people in this city. And it doesn't hurt that Tuuli Waanila's an interesting looking woman. She's not just tiny. She has elfin features, sandy hair, and slanty hazel eyes. All of which helps with film people; looks mean a lot to them. Also she sounds good. She's got a light accent that sounds pretty much Finnish.

And she's well named. Her full name is "Tuulikki," which means, like, graceful. Her Finn father named her that when she was born, and it turned out to fit.

Anyway, at Mr. Ethel's we got a booth in a corner, and when our orders had been taken, we drank coffee and talked.

"What do you think of astrology?" I asked her.

She cocked her head to one side, her eyes direct as usual. "Astrology? I'm not very informed about it. I don't practice it. But I usually look up my horoscope in the paper, in the morning."

"Really?"

"Sure. It's good to have a source of outside information. Psychics usually see better for others than for ourselves."

I didn't leave it at that. I had to pump her a little; it goes with my profession. "But astrology!" I said. "I mean, I can imagine people getting information through the S-matrix maybe, or something weird like that. But from the positions of the stars?"

She shrugged. "You read the papers."

"Not the horoscopes I don't."

"Did you read about the astronomer, Ashkenazi?"

"Do you believe him?" I asked.

"Nobody seemed anxious to try to prove him wrong." She paused, looking pointedly at me. "Why don't you tell me why you brought this up?"

So I did. "And now Ashkenazi's my

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job," I added. "Thanks to Mr. Paska. Oops, Pasco."

She wrinkled her nose. "Paska is about right for him."

"You know Pasco?"

"In my business he has a reputation. He hates people like me; he's the main agitator in California for laws to stop us from practicing our trade." She looked thoughtfully at me. "You've heard the saying, 'in the land of the blind, the one-eyed man is king.' "

"Yeah."

"The person who said it was mistaken. In the land of the blind, the one-eyed man is apt to be considered a liar and a fraud."

She paused again. This time her eyes seem to focus somewhere above and beyond my right shoulder. "You're likelier to find out something criminal about Pasco than about Ashkenazi."

"Are you serious?"

"Yes," she told me, "I'm serious."

"What should I look for?"

Tuuli shrugged. "I don't know. If you're interested in Ashkenazi, look way back. To when he was young."

"I plan to."

"Ashkenazi's not his real name; his original name."

"How do you know?" I assumed she'd read it somewhere. "What is his real name?"

"I don't know that, either. You should be able to find out, and it's something you really should look into."

"OK," I told her, "I will."

"And find out about his twin." She paused, frowning slightly. "His twin brother. I'm pretty sure it's a brother."

I didn't know how to take that—whether she'd read those things somewhere, or if she was being psychic. "And you say I could find something criminal about Pasco if I looked?"

"I'm not sure. Not if you looked right away. The feeling I get is a little confusing. It may be something he hasn't done yet."

"Huh! I'll keep that in mind," I told her. "Tomorrow I'll start checking on Ashkenazi."

An investigation contract with a public agency gets you quick, if indirect access to the confidential State Data Center through your computer. Assuming your computer has a videophone and a card reader; otherwise it's a slow and awkward process. You just call, insert your registry card, they check the card and your face against their records, then you insert the contract card so they know what's it all about. After that you tell them what you want, with a brief oral justification, and if it sounds reasonable to them, the information comes into your computer for your temporary use.

It could be tough to get stuff, but usually it's not. The people that wear the data access hat in Sacramento are pretty good—they know their job. As for "temporary use," you're supposed to erase stuff within three business days of contract termination. The information is flagged when you get it, and occasional inspections are made via computer from Sacramento, to check on closed contracts—make sure that stuff has been erased. I've heard that if you know how, it's possible to hold out on them indefinitely, and I have no doubt it's true. But Joe's got his own rules, regardless: if he finds you've held data

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over for even a few days, the first time you're reprimanded and the second time you're fired. That's part of the orientation pack when you go to work for Prudential. Plus he tells you himself, with his bushy black Irish-Cornish eyebrows drawn up in a knot, in case you haven't taken it seriously. He fires your ass, and the reason will be on all your employment references.

So anyway, I called up all the information on Ashkenazi in the state's files, with the exception of tax and census data. Tax records are accessible only if your contract is with the California Franchise Tax Board. Census data isn't accessible under any contract, and I'm told if you even ask for it, the state investigates you.

I learned a lot about Ashkenazi: His current address, past addresses with at least approximate dates, all kinds of stuff. But the most interesting item was that Arthur Aaron Ashkenazi was an assumed name. Just like Tuuli said. He'd been born Aldon Arthur Ashley, and had legally changed his name in 1973, seven years before I was born. There was no hint of why—no record of any crime, bankruptcy, or anything else that might have made him want to change it.

There was nothing there to focus an investigation on except the name change, and offhand that didn't look very promising. So I decided to interview Ashkenazi. I'd present myself as a freelance writer doing an article on spec for the pop-science magazine, *Cutting Edge*.

I had his unlisted number, but using it might bring questions I wouldn't care to answer, so I dialed his answering service, which *was* listed. The woman who answered had a face like a bulldog; I decided right away that he didn't want phone calls from strangers.

"I'd like to speak with Mr. Ashkenazi, please."

"What may I tell him the call is about?"

"It's confidential."

"Mr. Ashkenazi only receives confidential calls at his unlisted number."

I'd only waste my time trying to cajole. So I said, "Tell Mr. Ashkenazi I want to interview him. If I can't, I'll just have to interview his twin. Tell him that. If you cut me off, he's going to end up madder than hell at you."

Her look almost melted my set, and I wished I'd thought to learn his twin's name, if he actually had a twin. I shouldn't have overlooked that; using a name would have been more convincing. But after a couple of seconds she put me on hold—where I stayed for a long couple of minutes before Ashkenazi's face appeared on my box. He looked a little annoyed; nothing worse.

"What is it you want?" he asked.

"I've read your address to the Astronomical Society, and some of the things written about you. I'm preparing an article for *Cutting Edge*, and I'd like to interview you."

"I don't give interviews."

"I appreciate that, Mr. Ashkenazi, and I respect your feelings on it. However, I still plan to write an article about you. The direction it takes, and what I feature in it, depend on the information I can get."

He didn't get mad, at least not visibly. For a moment he just sat looking at me via our connection. "An inter-

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view," he said then, sounding resigned. "All right. Where are you calling from?"

"L.A."

He grunted. "This evening then. I'll give you an hour, beginning at seven. Do you know how to find me?"

"You're at 4231 East Encino Road. I assume that rental cars in Santa Barbara have the Montecito grid in their computers."

"They may, but I'm five kilometers outside Montecito, up in the hills; I don't know whether they've extended the grid out this far yet. If you have any trouble, call. I'll tell Ms. Bowser to put you through to me. My place is fenced, with a remote control gate. The call box will get the house, and someone will let you in. That's this evening at seven."

"Thank you, Mr. Ashkenazi," I told him. *Ms. Bowser!* I could believe it.

Then I got Sacramento on the phone again. I needed to call up the available information on his family, something I should already have done.

Since they developed a means of tapping the geogravitic field without being in contact with the ground, air transport has gotten cheaper and a lot more convenient, with virtually no risk of a crash. Floaters are AG of course—anti-gravity—stable in flight, easy to operate, quiet, and don't pollute like the airplanes did when I was a kid. From where I live, or from the office, if you want to fly somewhere, you drive two or three kilometers to the Larchmont Station. (The use of angel wings is illegal in the metro area.) Airbuses lift out of there for just about any sizeable town in southern California, with a shuttle leaving for LAX about every ten minutes for connections to everywhere else.

I caught the 5:15 airbus to Santa Barbara, and got there at 5:40 P.M. The air was clear as polished crystal, thanks to geogravitic power. With the mountains behind her, L.A. looked beautiful, the Pacific was magnificent, and the Sierra Madre rugged and wild. While Santa Barbara . . . what can I say? It's southern California! I love it.

At the Santa Barbara Station I caught a turkey salad sandwich, and at 6:23 was in a rental car headed for Montecito. The car's computer did have Ashkenazi's address, so to find it all I had to do was follow the route it showed me on the grid. Took me sixteen minutes; I was twenty minutes early. Instead of using the call box I dialed his number on the phone in the rental car, and told him I was there already—that if he wanted, I could drive around awhile. He said come on up to the house, and a few seconds later the reinforced gate opened.

His place was in the hills, on maybe a hectare of land, as it turned out. You couldn't see the house from the gate because the woods came right down to the road. The fence was well designed to discourage, though you could get in if you had the equipment. There was a concrete wall about a meter high, to keep anyone from busting through with a car, and about two meters of chain link above that, with the waxy luster of the new, tailored-molecule "hard steel." At the top was razor wire. Actually pretty mild for a place like his in these days of trashers. There weren't even dogs.

His driveway started in through a dense stand of scrub live oak with dark

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glossy leaves, but the house itself was surrounded by lawn, shaded thin near the house by some big encina oaks. The house was large but not huge. It sprawled, partly one story tall and partly two, with big windows and glass doors. There were five paved parking places. I pulled into one of them, went up on the broad porch, and knocked. A man answered it, wearing a sort of semi-uniform, asked me into an entryway, and pressed a button.

Half a minute later, Ashkenazi was there, shaking my hand, cordial as you could ask for. Making the best of a regrettable situation, I suppose. He looked heavier than on the video, but not unhealthy. I suppose he exercised some, maybe brisk walking or an exercise machine, but ate more than he should. I could sympathize with that. We went into a room lit by the amber rays of a setting sun, and sat down.

He looked at his watch. "Six forty-four," he said. "We might as well start. Let me ask the first question: How did you know about Eldon?"

Eldon was his twin brother; that was one of the things I found out that afternoon. Their parent's names were in the data on Ashkenazi, and I'd called up information on them. There wasn't a lot of it, of course. They'd lived most of their lives before so much data had been kept. But their children's names and birth dates were there.

"Mr. Ashkenazi," I answered, "a good writer learns techniques, just as an astronomer does. I haven't taken the time to learn much about your brother, though. I haven't decided just what form the article will take, so I don't know what's relevant to it. The first thing I'd like to hear about is your research."

"I presume you've read my paper."

"Read it and watched you give it on video."

"Umm. Then you saw how it was received by my professional brethren."

"Right. Including a few interviews with other astronomers; they said what you talked about was astrology, not astronomy."

Ashkenazi gave a wry smile. "Astrology without astrological terminology. I followed basic astrological principles, but abandoned the traditional framework and analyzed large volumes of data. It's considerably more sensitive and accurate than astrology as traditionally practiced." He grinned. "I call it 'predictive astronomy,' to irritate the astronomical fraternity."

"But apparently you don't know why it works," I answered. "If you could have described the mechanism, you would have. Surely you've got some kind of theory?"

He shook his head. "If Ali Hasad's 'Limited Theory of Generated Reality' is valid, it provides a partial explanation."

One of the advantages of reading 800 to 1,200 words per minute is, you can read a lot of books and magazines. So I knew a little of what he was talking about. "Isn't Ali Hasad's theory rejected by scientists?" I asked.

"By most of them, but not all. If you polled the physics community, maybe seven of ten would reject it out of hand, two would withhold judgment but express strong skepticism, and one would say something like, it's heuristically in-

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teresting and might lead to new understandings.

"But science isn't supposed to be democratic, in the sense of a vote making a theory viable or valid. Most, maybe all, of those who reject Ali Hasad's theory haven't read it. Except perhaps the summary of his first paper on it. And aren't likely to.

"It's chief problem is, it supports, and thus revives, an old contention of Fred Hoyle's, based on the values of basic physical parameters of the Universe."

I knew what he was talking about, but I didn't interrupt.

"The basic parameters are those fundamental forces on which the Universe depends for its characteristics. And if those parameters were even moderately different than they are, we wouldn't just have elements and planets and life somewhat different than we find them. We wouldn't have them at all. And Hoyle couldn't accept that those parameters are what they are simply by accident. He contended that it must have been designed, that this Universe is an artifact programmed by some super intelligence operating outside our Universe.

"An intelligence that some people decided must be God. Which is a word with a lot of unfortunate Bronze Age superstitions attached to it."

He cocked an eyebrow. "Have I thoroughly confused you?"

I shook my head. "I'm familiar with Hoyle's view," I said. "I never read anything by him, but I read an article about it, years ago. It sounded reasonable enough to me. And when I read a description of Ali Hasad's theory, it did remind me of Hoyle. It also seemed interesting as hell to me. But of course, I'm in no position to evaluate it scientifically."

Ashkenazi chuckled. "Neither are physicists that won't look. It's interesting that so much of advanced physics is nonexperimental. Which in the traditional sense means nonscientific. That's not to knock it. Given the problems, they do the best they can. For decades now, the frontiers of physics have lain largely in the realm of mathematics. The subject demands theories that commonly *can't* be tested physically. They test them by seeing how consistent the math is, particularly with other, already-accepted math that describes physical phenomena.

"That's a simplification, I'll admit, but basically it's accurate. And Ali Hasad's math *is* compatible with the Meissner-Ikeda Lattice. And accommodates the math, such as it is, of the S-Matrix.

My hour was melting, but I let him go on. I had a notion he might let it stretch as long as it took.

"You don't look old enough," Ashkenazi went on, "to remember when the know-nothings had the Tarzan books removed from some libraries. In Tennessee I think it was. They said that Tarzan and Jane weren't married, were living in sin, and therefore the books weren't fit for young people to be exposed to.

"Actually they were married. In book one, I think it was. Jane's father was a preacher, and they were married here in the United States. In Wisconsin, if I remember correctly. The damned know-nothings had never read the sonofabitch.

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Typical. Well, Ali Hasad's critics haven't examined his math; there are know-nothings in science, too.

"Considering the track records of all the earlier mathematical super-theories, Ali Hasad's will probably turn out to have serious holes and loose ends, but its critics aren't going to discover them till . . . "

He stopped, grinned, and shook his head. "You punched my buttons there," he said. "You're not recording this, are you?"

I was, and admitted it; my recorder was beside my chair, inside my shoulder bag. "But you'll have a chance to critique the manuscript before I submit it," I told him.

"Huh! That's something, anyway. As for my work, it has no theory. It's totally empirical. Ali Hasad's theory provides a partial basis for a possible explanation, but that's no credit to me." He chuckled again. "Maybe Hoyle's super-intelligence outside the Universe was playing games with the intelligent life-forms that developed on its planets. Maybe He, It, programmed in some correlation between events and celestial positions, without any cause-and-effect relations between them at all. Just to see what we'd make of it."

He turned more serious then. "I'm not worried about explanations. Arne Haugen had only a rough notion of the basis for the geogravitic power converter, but that didn't keep him from inventing it. I've established a certain predictive and planning value in astrology, particularly in the revised and sharpened form I developed empirically. It's really no big deal to me if the scientific community doesn't accept it. It would have been nice for the ego if they had, but I'd have given odds of a hundred to one against it, and taken all the bets I could cover.

"My career doesn't depend on their approval. My degrees are in astronomy, but I've never been employed in it. I made my initial money in computer software and consulting, way back in the days before the PC. My real wealth I made through investments. Investments guided, I might add, by every predictive factor, including astrology, that I can program into a computer. Also I have clients, as many as I care to deal with, who don't give a damn about explanations, or compatibility with current theory. They're interested in results, and that's what I give them."

With that, he seemed to have run down. I nodded. "And what does Eldon think of all this?"

His eyebrows raised. "You *don't* know much about Eldon, do you? He probably doesn't think about it at all. He's an invalid who's been brain-damaged since 1973. From an auto accident."

"Ah. Then I probably shouldn't bother him."

"I'm quite sure Veronica would prefer that you not."

"Do you, uh, contribute to his support, Mr. Ashkenazi?"

He frowned. "Really, Mr. Seppanen, I don't care to . . . " He stopped then, lips pursed. "I will answer that question. A number of years ago I set up a trust fund. It's not really necessary. Veronica is a capable provider; they'd get by quite adequately without it. She's the trust fund's payee of course, not Eldon.

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"She's a COGS," he added drily, "and COGS put a lot of emphasis on being financially honorable and intellectually shabby."

So his sister-in-law was a COGS! She wouldn't like what Ashkenazi was into at all then. The Church of God in Science—COGS—is an attempt to marry liberal Christianity and classical science. It's grown to a major denomination since the plagues of 1999 and 2000; it's one way a lot of people are trying to come to terms with the accelerating changes in the world. And the way that COGS feel about anything like astrology or psychic phenomena pretty much ranges between contempt and hatred.

And suddenly I got the idea that if I checked on Donald C. Pasco, I'd find he was a COGS, too. It would fit him like a glove.

"Thank you, Mr. Ashley—excuse me, Mr. Ashkenazi," I said, getting up. "You've been very helpful."

Calling him Ashley hadn't been a slip; I wanted to see if he'd react. He had, with a look of annoyance. It rekindled my curiosity about the name change.

"Maybe I'll start checking my horoscope in the paper, mornings," I added. "It might prove helpful to me."

Driving back to Santa Barbara, I examined what I'd learned. There was a quite lot of it; I just didn't know where it led, if anywhere. Also, I realized that I liked Arthur Ashkenazi. He seemed like what the Jews call a "mensch," which I've had explained to me as someone who's able, responsible, decent, and feeling. I hoped I *didn't* find anything discreditable about him. If I did . . . well, we'd see.

Meanwhile it was my job to look. So the next morning I hired a statistically sophisticated CPA intern to check the entries—the dates and contents of the actual publications—and the computations in Ashkenazi's research. It was a lot different than anything she'd ever done before, but she had the right attitude—she was a skeptic who liked a challenge—and it seemed to me she had the tools.

Then, independent of that, I went to Pasadena and hired me a master's candidate in astronomy at Cal Tech, to check the same stuff from the viewpoint of an astronomer. I'd met him at Carlos's that summer, at supper, a college friend of Carlos's son, Keith Katagawa. It seemed to me he'd be reasonably open-minded; he was a drifted-away member of the "New Gnus"—the Church of Technical Gnosis—and you had to be pretty damned flexible to even consider that one.

I also visited the Santa Monica High School library and looked through the 1968 and 1969 yearbooks. I got a list of students that might have been personal friends of Aldon Ashley—Arthur Ashkenazi—kids who'd been in the same student activities. Then I did essentially the same things with the UCLA yearbook for 1973. After that, it was back to the State Data Center for locations and phone numbers—the drudge work of investigation. Nearly half the people I was interested in had died in the plagues in 1999 and 2000, but phone calls still got me some worthwhile information.

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The most useful was a friend of both his high school and college days, who still exchanged Christmas letters with him. They'd see each other every five or ten years. The guy lives in Minneapolis, so I didn't talk to him eyeball to eyeball, but a telephone interview turned out useful.

For one thing, I learned why Aldon Ashley had changed his name, and there was nothing discreditable about it. The same weekend he graduated from UCLA, he'd gotten in some kind of fuss with his sister-in-law, whom this guy characterized as a real bitch. And Eldon, Ashkenazi's twin, got upset listening to it, and left to drive around. And to smoke dope, something Eldon was into. He ended up losing an argument with an overpass abutment at a high rate of speed, which is how he got to be a brain-damaged cripple.

Then the sister-in-law told their father that the reason Eldon had done this was because Aldon had insulted him. And for whatever reason, the father believed this and raised hell with Aldon. Told him it was his fault that his brother had wrecked his life. Apparently overlooking the daughter-in-law, the dope, and Eldon's decision to go out and speed on the freeway.

So Aldon left home, and that summer changed his name. Something his father wouldn't learn about for years, the break was that complete. When Aldon's grandfather was young, he'd resigned from being Jewish, and changed his name to Ashley. Aldon, as a sort of resignation from being his father's son, had switched back to something about as Jewish as he could find. (Look up Ashkenazi; I did.) He'd even learned to speak some Yiddish. It was his gentile mother, though, who secretly helped him through grad school at Arizona; she'd inherited money of her own.

All of which was interesting, but didn't seem to lead anywhere. It occurred to me that maybe I *should* write that article about Ashkenazi, or maybe a whole damn biography. Make a truthful man of myself, *ex post facto*.

Also helpful, his old buddy gave me the name of a woman whom Ashkenazi had gone with for years, in their middle age. Again the data center gave me location and phone number. After setting up an appointment with her, I took a short airbus hop down the coast to Oceanside, rented a car, and interviewed her in person.

She and Ashkenazi had dated for "several years." She'd liked and respected him a lot, she said. But she liked to travel and entertain, and had money of her own—she was a widow—while Ashkenazi liked to stay home, read, walk, and play with his computer. "Arthur's idea of a night out," she told me, "was to take his portable telescope and we'd drive up to Pine Mountain Summit, in the Sierra Madre above Ojai, to look at stars. Our most typical dates were pleasant drives along the coast, stopping to walk on the beach, and then have a nice meal at some expensive restaurant, followed by a show."

Which she'd enjoyed, she said, but they weren't enough. She'd ended up marrying a widower who also liked to travel and entertain.

She also told me about Ashkenazi setting up a trust fund for his brother, with his hostile sister-in-law as the payee, something I'd already verified

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through the data center. Ashkenazi might or might not hold grudges, but he could set them aside and do the right thing. A mensch, all right. I was getting to like him better all the time.

I also got in contact with a guy who'd known him pretty well in grad school at the University of Arizona. The picture there was a set of grad students with a lot of attention on the problems of getting jobs once they graduated. People who'd spent so much time on their graduate duties and studies, they'd hardly had any time for social life.

Ashkenazi never did get employment in astronomy. But in the process of getting degrees in astronomy, he'd gotten well educated in math, statistical analysis, computers, and programming, so he took a job with a Santa Monica company called "Spectronics." Within two years he was an independent software consultant and trouble shooter, and had built a successful business. Meanwhile investing. Successfully. Another phone interview with Ashkenazi's Minneapolis buddy got me the information that those were the years he'd begun "playing with astrology."

A couple of people that Ashkenazi had done software consulting for in those days said his prices had been very reasonable and his service good. And that he'd always been pleasant and easy to communicate with.

By 1992 he'd dropped out of the software business, apparently living on his investments. I couldn't find out much about his investment activities in those years; the broker he'd dealt through had suicided in the Great Crash of '96, and the broker's secretary had died, along with more than a billion other people, of Epidemic Viral Meningitis in the year 2000.

I left his recent financial activities to the audit office in the Commerce Department.

So I'd learned a lot about Arthur Ashkenazi. And none of it was going to make Pasco happy. I woke up one morning with the decision to lay it all out for Carlos and recommend that we tell Pasco that was it. I was composing the recommendation in my mind when I walked into Morey's Deli on Beverly Boulevard, half a block from the office. I generally eat breakfast there; if I eat at home, I tend to keep going back for refills. At Morey's there are no refills except coffee, and he's got a good, low-cal, health food breakfast for guys like me.

When I walked in, I saw someone wave to me, a guy they call Indian. He wears a pheasant feather in his sweatband; calf-length, moccasin-styled boots with a fringe on their folded down tops; and a beaded leather vest. I went over and sat down with him. Indian's got hair about the color of mine—halfway between blond and brown—a red, Viking-looking mustache, and a ruddy complexion. Pretty un-Indian looking, except for the nose and cheekbones. He insists he's a quarter Chippewa though, and that his mother grew up on the Bad River Reservation in Wisconsin.

Whatever; he's an Angeleno, born and raised. Tallish and lean, he's a strong-looking guy, works for Yitzhak's Transit as a casual. The moving business isn't predictable; some days Yitzhak's got work for Indian, and some days he doesn't. When he doesn't, In-

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dian comes in to Morey's, about three doors from Yitzhak's, for coffee and a fat, chocolate-glazed doughnut. I see him quite a lot at breakfast.

Yitzhak's a New Gnu, and most of the people who work for him are New Gnus, but not Indian. Indian's a Loonie, belongs to a cult of Moon worshippers. I guess they don't actually worship the Moon, but they meditate on it or something like that. Anyway it occurred to me that a Loonie might know something about astrology, and the astrology angle was one thing I hadn't looked into. Maybe it was time to start. So after I gave Morey's daughter my order, I said to Indian, "What do you think about astrology?"

"Don't know much about it," he said. "Moonbeam does though. She checks the horoscopes in the paper each day and tells me if there's something I need to look out for. Moonbeam's pretty spiritual, you know? She's part Indian too, and an Aquarius on top of that, so she's got a lot better feel for that stuff than me. That's why she's our house mother." (They live in an old house with about eight or ten other Loonies, on one of those goat-trail streets that climb around in the Hollywood Hills.) He stopped and examined me a moment. "You got a girl friend? You never talk about one."

"Yeah, I've got a girl friend. Her name is Tuuli."

"Tooley? That's a neat name! What does Tooley do? For a living I mean?"

"She's a professional psychic. Does consulting, mainly for people in the movie industry."

"Hey! That's a coincidence! We got a fortune teller in our house!" Indian's life is full of coincidences. "Her name is Becky; she's from Sacramento. You know they made a law against telling fortunes in Sacramento County?"

I did, but to keep him going I said no I didn't.

"Yeah. Ain't that crazy? What kind of country is this, they can make laws against telling fortunes? Becky didn't have no job, so she told a guy his fortune, and he's a cop. She couldn't pay the fine, so they threw her in jail. And when she got out, she still didn't have no job. A friend of hers, a hooker, give her the money to come down here."

He grinned. "The hooker said she'd get even for her with the guy that got the law passed. She didn't say how; maybe he's a customer or something."

Sometimes I just half listen to Indian. Lots of times he rambles; this time he had my attention.

"What's the guy's name?" I asked.

"I don't know. She said, but I don't remember."

"Wellington?" I threw that out to test him.

"Nah, not Wellington."

"Pasco?"

"That's it! Pasco! You know about him?"

"I've heard of him. He doesn't like psychics. This Becky: does she tell fortunes here?"

Indian looked wary. "It's not against the law here, is it? Nah, can't be, not in L.A. Besides, your girl friend is a psychic." He grinned then. "Yeah, Becky tells fortunes here."

"Is she good?"

"I don't know. I guess. You want your fortune told?"

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"I thought I might. Tuuli won't tell me mine. Where can I find this Becky?"

"There's a house on the corner of Franklin and one of those little streets east of Bronson. It's got a little sign: *House of the Moon*. They rent rooms to fortune tellers to tell fortunes in. It's close enough that Becky don't need no car, or to take the bus or anything. She just walks there from the house about a mile. The hill climbing's good for her."

He told me Becky wouldn't leave for work till nine or so, and gave me the phone number where he lived. He stayed and talked to me until I finished eating, then I went to my office and got Becky on the phone. A reading would cost me ten dollars, and she'd be at the House of the Moon by ten.

I was too. She called herself Madame Rebecca, wore a head kerchief, a black satin shawl with white stars and moons on it, and a dress to her ankles. The face beneath the kerchief was small and pointy, vulnerable-looking. I suspect that going to jail in Sacramento wasn't her first visit from hard luck.

The fortune she told was interesting: I had entered a time of challenge and uncertainty, she said. And if I passed safely through a time of danger, I would overcome the challenge. There was a special person in my life, someone with whom I shared a special communication, who would disappoint me, but if I persisted, I'd win there, too. All this with appropriate silences, frowns, and passes at her crystal ball.

The whole thing was general enough to give me a choice of things it might allude to. But even so . . . I could interpret the uncertainty and challenge as the Askhenazi case, though I couldn't imagine any danger involved. As for the special person in my life, I could take that to mean Tuuli; we did share a special communication, in that she and I both speak Finnish. Though hers is good, while mine's a limited knowledge of the Upper Michigan dialect, which was already disappearing when I was a kid. I learned it from my dad, and after he was killed, my older half-brother Sulo and his wife used to talk it to me.

When Madame Rebecca had finished and I'd paid her, I got down to the questions I was really interested in. "I got your name and number from Indian," I told her. "He told me you're from Sacramento."

She admitted she was.

"I'm going up there on business next week. I'll only be there a couple of days, so I won't have much time. Can you recommend a lady I could connect up with there? Someone reasonably nice looking, who's healthy and likes a good time."

She gave me a name: Marilyn Vanderpol, and a street and approximate block number. She didn't remember the phone number or exact address.

Back in the office I checked with the data center again. And learned that Marilyn Vanderpol was deceased, dead of a drug-induced heart attack. Probably not that unusual for a hooker, I told myself. On a hunch I also got the name and number of the investigating officer, then called him, identified myself, and gave him my contract number. I asked him about the death of Marilyn Vanderpol.

Sergeant Luciano is the kind of cop

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that doesn't have to refer to the files. He gave me the information off the top of his head, and I had no doubt he knew what he was talking about. The evidence, Luciano said, should still be on file because the death appeared to be crime related. That is, it was apparently drug connected. It had happened two months earlier; they'd throw the evidence away in another month, unless they needed the space sooner.

"You said it was *apparently* drug connected. What did you mean by apparently?"

"Officially it was drug-connected," he said. "There was no evidence of previous drug use, or even an alcohol problem. But she'd apparently been servicing a john when it happened, and the drug was Harem Smoke. Supposed to prolong and intensify climax, so it was probably his. And Harem Smoke's been known to trigger heart attacks . . . in males at least; males in climax." He shrugged. "A coroner's decision is hard to argue with. He's the expert."

I could see what was bothering Luciano: The explanation looked half-assed. But Vanderpol was a hooker, and besides, if she had a heart attack, she had a heart attack. Why complicate it? "Look," I said. "I'll fly up there tomorrow morning. Can you show me the evidence then?"

"Tomorrow's Saturday," he pointed out.

"I know," I said. I could hardly justify the trip as a job expense. I'd have to go on my own time and money.

"I'm on duty tomorrow till noon," he told me.

"I'll be there by ten," I said.

* * *

I was there at 9:32, according to the clock on his wall, and Luciano showed me his brief written report, plus the evidence in a plastic bag. Along with the report were photographs and a diagram. Vanderpol had been sprawled dead on the floor, naked. In the plastic bag was a small fumer that had held the Harem Smoke, a product of American criminal ingenuity. I remembered my mother and father shot dead in our living room, and felt the skin start to twist around my mouth, gut tightening, mind thickening. I took a couple of deep quiet breaths, and did a brief mental drill my therapist had taught me afterwards.

Other items in the bag included a hundred dollar bill that had been lying on an end table in the room; a small, clear, plastic pillbox that looked empty; and a plastic needle cap with a flattened tip and ornamental grooves. "What's in here?" I asked, pointing to the vial.

"Semen. Found on Vanderpol's face."

I didn't get any subconscious twitches from that, but I did from the needle cap. "You know what this is," I said, pointing at it.

"Sure," Luciano answered, puzzled that I needed to say. "It's a needle cap. I found it lying on the shag carpet. Stepped on it, actually, or I'd never have seen it. One of the outpoints in the scene was, Vanderpol's arms showed no signs of needle usage, and there wasn't any needle lying around. Also, the only drug in her system at the autopsy was Harem Smoke. The needle could have belonged to the john, of course, and he could have taken it with him. Odd though."

"It's not that kind of needle cap,"

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I told him. "Unless I'm mistaken, this is off a cork popper. Look at the size of the hole where the needle fitted. Druggies don't use needles that big, or that long. Besides, it looks like it came off a cork popper."

He looked puzzled. "Instead of using a corkscrew," I told him, "you push a long needle through the cork and release a jet of compressed air. Pops the cork right out."

He nodded thoughtfully. So far, so good, I told myself. But so what? "Was there a wine bottle there?" I asked him.

"Yeah, matter of fact. Two-thirds full, on her kitchen table. But it was Gallo port. I remember that because it's what my wife gets. They've got a screw cap."

"Hmh!" Something was niggling my mind, just below the level of consciousness. It would come to me. "Look, can you do something more for me?"

"Maybe."

"I'd not only like this stuff kept from possibly being thrown out. I'd like it sequestered."

Luciano frowned. "Sure. I can do that. What's going on?"

"I'm not sure., I'll let you know as soon as I do. Did you get prints?"

"Off the bill, the wine bottle, and the needle cap," he said. "Didn't do anything with them though. The coroner's report, you know."

I did know. And she was a hooker, and cops always have too much to do anyway.

But the thing about the needle was surfacing in my mind. With Luciano beside me, I borrowed an official phone and used my code card to dial a friend of mine at his home, an assistant L.A. county coroner. "Elisio," I said, "what would be the effect of injecting a person with a jet of compressed air?"

"It depends on where they are injected. In the brain or spinal column or heart, or a major artery, it would kill them."

"Would the injection into one of those give the appearance of a heart attack?"

"An injection into the heart would *cause* a heart attack."

"If a woman was injected in the heart, what evidence would there be of the injection? Assuming she died at once. The needle would have been fairly large—the needle of a cork popper. Are you familiar with them?"

He nodded. "We've got one at home. There might be a spot of blood at the point of injection. The perforation would be visible anyway, if you looked closely enough. A close examination should show minor damage to capillaries in the skin and intercostal muscle, and in the heart. If the needle didn't penetrate into one of the chambers, and the compressed air was released into the myocardium itself, there'd be conspicuous local tissue damage."

"And that would be deadly too?"

"Definitely. It would be a severe myocardial trauma."

It helped to have had introduction to Forensic Medicine, back at Northern Michigan. Luciano looked impressed and pleased. "I'll write this up," he said, "and check those prints against the files."

"Shave Vanderpol's head, too," I told him. "She wouldn't have held still for someone stabbing her with a needle like that, unless she was unconscious.

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She may have been blackjacked; if she was, there ought to be discoloration. And possibly swelling; I'm not sure. And look under her left breast. That's a logical place to have injected her; it wouldn't show there. Also, the left breast's a good place to check for prints."

I left Sacramento with something further to do. The prints in the national fingerprint archives are from police files. Access to print files of the military, government employees, etc., weren't accessible without a subpoena. And you needed substantive evidence to get one. But Donald Pasco would have left prints on the video disks he'd brought with him. They'd have other prints on them too, but with today's technology you can get clear images of prints overlain by prints, along with how many layers down any given print is. If prints on say the bill and the needle cap, matched any of the prints on the disks, that would be evidence enough for the subpoena.

Enough too to get a hair sample for a DNA print, to compare with a DNA print of the sperm. Always assuming there was clear evidence she'd been killed by a compressed air injection.

There were various prints on the disks and the contract. I eliminated some of them as Joe's, Carlos's, and Fidela's (she's Joe's secretary); we've got ours on file. The rest of the prints, with a note, I sent from our computer to the police computer in Sacramento, attention Sergeant Luciano.

Then I went home, stopping for a six-pack on the way, stripped down to cutoffs, and spent the rest of the day on my recliner, watching the baseball playoffs on the telly. Getting up mainly to put a frozen super-pizza in the oven. I felt like I'd earned it, calories and all, even if I hadn't made much progress on the Ashkenazi job.

On Monday morning I told Carlos what I'd done, also what I'd learned about Ashkenazi, and recommended we turn in what we had, even though it was inconclusive. Calling it done. He thought about that for a minute.

"No," he said, "stay with it for now. If they do arrest Pasco, you can write up what you've got, and we'll go over it with whoever replaces him as director there. Chances are that whoever it is, he'll agree to terminate the case. Probably insist on it."

So I took some compensatory time off and went to the club, where I stretched and did katas till I'd worked up a good sweat, then put in an hour on the exercise machines, twenty minutes on the bike, and an hour dozing on the grass in Bronson Park. After that I ate lunch and went to a matinee of *A Man For His Time* at Mann's Chinese, where I ate a tub of popcorn. Finally I went back to the office.

There was a message for me from Luciano. Vanderpol had been sapped and murdered, just as I'd figured. The prints on the needle cap and the bill were Pasco's. So were prints on Vanderpol's left breast. Pasco was being held for Murder One, in lieu of $500,000 bail, and DNA prints were being made from the semen and a fresh hair sample. I played it for Carlos, and he congratulated me.

"Write up your report on the Ashkenazi job in the morning, and we'll see

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what they say at the Anti-Fraud Division."

Then I went out to the parking lot, started my car, and turned on the radio to KFWB News. I hardly ever listen to a news station when I'm driving; it's distracting. But this time I turned it on just when I powered up in the parking lot—

Just in time to hear about the murder of Arthur Ashkenazi! The body had been discovered that morning, and none of us had heard about it! He'd been shot in his bed, through the head.

I was back in the elevator in about twenty seconds, up to the eleventh floor, and caught Carlos just getting ready to leave. I told him what I'd heard.

"Ashkenazi's place is outside of Montecito," I told him, "so it'll be under the sheriff's jurisdiction. We ought to get the contract for it. We can tell them we've been investigating Ashkenazi for the State, which gives us a head start on the case."

He agreed, and got on the phone to Santa Barbara right away. Joe was out, so Carlos had the authority. The sheriff went for it, and Carlos told him I'd fly up that evening. I took time for a quick supper, at Morey's again, and left.

At the Santa Barbara sheriff's department, I learned something about the case that hadn't been released. Ashkenazi had been critically ill when shot; conceivably even dead, according to Sheriff Nyberg. He'd been shot through the brain, a shot that wouldn't have caused much bleeding alive or dead. The reason for keeping this quiet was the disease appeared to have been a viral meningitis, and they hadn't wanted to start a panic; people would remember EVM, the epidemic viral meningitis that had killed more than a billion people, planetwide, in the year 2000.

Tissue samples had been sent to the California Department of Health Services, attention the chief of Vector Biology and Control, the only person who'd been informed of the source and circumstances. The Santa Barbara county coroner hadn't informed his secretary, hadn't entered it on his autopsy report, hadn't even notified the County Health Department. Locally, only the sheriff had been informed. The sheriff told me because I was now the investigator on the case, and made me sign an injunction not to tell anyone without his approval. Even his chief deputy didn't know.

Viral meningitis! It made me feel squirmy, just to be going out there. A deputy drove me; it was dark when we arrived. There was another deputy at the house, and Ashkenazi's servants were still there.

The bedding was just as it had been when the body was found, except that Ashkenazi had been somewhat wound up in the sheet, and they'd had to cut it to disentangle him. There wasn't much blood. More sweat stain than anything else, from the meningitis. The pistol must have had a silencer; the shot hadn't wakened the servants. There'd been faint powder burns; the shot had been fired from about three feet, from the side toward the window. The gunman must have stood almost against the side of the queen-size bed. The 9mm slug had been dug out of the floor for ballistic tests. There was no cartridge case; probably the action had been hand

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operated to give more effective silencing.

The house doors had all been locked —that was done by a single switch—and there'd been no forced entry. But the gunman would have had no trouble entering through the window, which had been open. A little discomfort, but no real difficulty; the insect screen was electronic. The hard part would have been getting to the window, but it wouldn't have been impractical for an active person: climb the encina oak in the side yard, walk out on a massive limb, then step off on the first floor roof and walk to Ashkenazi's bedroom window.

I talked to the servants, a middle-aged Hispanic couple who spoke English easily and well. At about 5:20, Mr. Ashkenazi had told Mrs. Ruiz that he was going to eat supper out, something he did only occasionally, and almost never without giving her a lot longer notice. He'd seemed quite cheerful. "Mr. Ashkenazi was a very nice man," she added. Then her face crumpled, and I waited until she'd had a brief cry. He'd left the house at about 5:30, and returned at 7:28; she'd looked at the clock when she heard him come in.

"Did you notice if he seemed well at the time?" I asked.

"Well? I don' know. I didn' actually see him. But I heard him talkin' to his bird, his parakeet, when he walked through the livin' room, and he sounded the way he usually sound. Nice and frien'ly." Her voice broke, and she started to cry again.

I made two working assumptions: one, that somehow the supper date had been connected with Ashkenazi's death, though I had no idea how. And two, it sounded as if the date had been set up just shortly before he mentioned it to Mrs. Ruiz.

When she calmed down again I asked: "Did he have any company this afternoon?"

Ruiz answered this time. "No sir. Nobody been here for three, four days."

He must have eaten somewhere fairly near, to have left at 5:30 and gotten back at 7:28.

After a few more questions, we left. As we drove down the twisting, somewhat crumbling blacktop, I found my attention going to two people: Veronica Ashley and Donald Pasco. Two unlikely suspects. Presumably Veronica Ashley was more or less Ashkenazi's age, and I couldn't picture a woman in, say, her mid-fifties to sixty climbing that encina and entering Ashkenazi's bedroom from a roof. As far as that was concerned, I couldn't picture Pasco doing it either, and anyway he'd been in jail by then. Following that line of reasoning, the gunman must have been a hired professional, and it occurred to me that the supper date might have been to somehow get Ashkenazi away, and the gunman onto the property. Which would suggest that the servants were in on it. Somehow that felt wrong, unlikely at least, but it was all I could come up with.

I decided to sleep on it.

I woke up the next morning knowing what I had to do. Not *why*, but what.

Meanwhile there was the matter of breakfast. The evening before, when I'd arrived back at the Larchmont Station, I'd stopped at a Nielssen's, bought a

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half gallon of butter brickle, went home, and binged out on ice cream. So to partially make up for it, I breakfasted on cottage cheese, Ry Krisp, some carrot sticks, and black coffee. My low cal, high protein penance. Then, having halfway atoned for the binge, I went to the office and accessed the state's data on Veronica Ashley.

It started off with her address, phone number, and social security number, then got into the more personal stuff. She'd been born Veronica Sue Pipolli on 10 November 1950, in Culver City—an Angelena all the way. Married Eldon Robert Ashley, 21 March 1972, received her BS in biology *magna cum laude* from UCLA on 2 June '73, and her MS in molecular biology—*summa cum laude*, no less—two years later. After five years as a lab technician in the med school there, she'd moved to the Genetics Research Lab in the biology department, as a research assistant. A level she'd stayed at for more than twenty years, the cost of not having a doctorate. She'd been jumped to research associate in April 2000. Like everything else, the research staff and the supply of new Ph.D.s would have been decimated by the Great Flu and EVM, and they'd needed to fill vacancies, Ph.D. or not.

Her father had died in an auto accident in October '75, her mother in the Great Flu in December '99.

She had memberships in Phi Kappa Phi, which was no surprise given her scholastic record, and the Church of God in Science, which Ashkenazi had already told me.

And Veronica Ashley had a criminal record! Not much of a record, a misdemeanor: disturbing the peace. Specifically blocking the entrance of a church and interfering with worship, during a demonstration at the Church of Technical Gnosis in West L.A., in June 2006; the New Gnus were into psychic beliefs and practices. In August '09 she'd been detained, then released without charge, after reportedly throwing eggs at the windows of the Hollywood Hilton, and at registered security officers, during a demonstration against an International Conference of Parapsychologists.

So she was not only a COGS; she was an activist member. Whatever malice she may have felt for her brother-in-law earlier, his new astrology must have pushed her mad buttons pretty hard.

No registered firearm, and no membership in a shooting club. Which didn't prove anything, but it was suggestive. People don't generally go off to commit premeditated murder with a handgun unless they've got some familiarity with one, some sense of at least marginal competence.

I figured to go talk to her, and to Eldon if he seemed aware enough. But just now she'd be at work, so it was time to follow up on the only real lead I had, thin though it seemed. Data Center at Sacramento got me the record of the previous day's phone traffic to and from Ashkenazi's residence. There almost wasn't any: two calls received through his answering service, and just one on the direct line. That one was made from a Dairy Delite in Ventura, at 5:14 P.M. The timing was perfect, though Dairy Delites weren't the kind of place I pictured Ashkenazi eating at.

I keyed directory assistance, and a

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page came onto my screen from the Ventura directory. There was only one Dairy Delite there, the cursor flashing beside it. The number didn't match the one on the list, but that was no surprise. The call to Ashkenazi would have been from their pay phone.

I memorized the address without trying, a matter of intending to remember. It's a knack I have that's a lot handier than writing everything down. Next, accessing the data center again, I got color copies of the photos from Veronica's and Ashkenazi's driver's licenses. And finally I called the Dairy Delite number in the phone book, which got me an order girl, as I'd expected. I asked her who worked the cash register, weekdays at suppertime. The manager did, she told me. He came in at noon and usually stayed till nine or ten.

Carlos had looked in on me while I was on the line to Ventura, so I went to see what he wanted. He'd had a call from an Inspector Zebriski in Sacramento, Sergeant Luciano's big boss. The DNA print from the semen was Pasco's, and the district attorney said they had an ironclad case. The inspector was very happy with Prudential, which of course reflected back on me. I could have that. I didn't plan to be a junior investigator all my life.

After lunch I drove to Ventura and found the Dairy Delite. I'd never been in one before. It turned out to be more than just an ice cream place; they had burgers, chicken, a salad bar . . . the whole list. It was a little past 2:00 P.M. The guy at the register wore a tag that said *Frank*, and beneath it, *Manager*. I showed him my ID and contract cards, and asked to talk to him privately, so he took me to his office. The plaque on the door said *Mr. Piper*. Apparently the manager's name was Frank Piper, though it didn't seem important at the time.

I showed him the pictures of Ashkenazi and Veronica Ashley, and asked him if he'd ever seen either of them before. He said he'd seen Ashkenazi's picture in *Time* magazine, was all.

"In what connection?" I asked.

"Damned if I know. I didn't read the article. What'd they do? Rob a bank?"

"One of them died, the other one didn't." Then, for no reason I can think of, I added, "The poisoner and the poisonee."

"Huh! If you know that, why snoop around any further?"

"You go to court with as much evidence as you can muster," I told him.

I had a fishburger then and left. It felt to me as if I'd just wasted a couple of hours on a nothing lead, but you get used to that in my profession. The names of the game are thoroughness and patience. Two of the names.

My next stop would be Veronica Ashley's place, but I didn't want to get there too early. A little before she got home from work would be about right, maybe 5:15. So, it being a sunny day, I drove to a nearby beach, took off my shoes, and had a nice, hour-long hike along the surf line, enjoying the feel and smell of a sea breeze, and getting my feet wet now and then. After letting Fidela know of course, back at the office, so no one would wonder why they couldn't reach me. When I got back to the car, I rolled down my windows, let the seat back, and took a nap.

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My computer woke me up at 3:30, and I headed for Westwood and Veronica Ashley's address, stopping at a restaurant on the way to brush my hair. Her place was an older house, probably from before World War Two, because the glass doors were made up of a lot of little panes instead of being single pieces of safety plate. It was pink stucco with two-stories, pseudo-Moorish, and had a small balcony upstairs in front with a little wrought-iron railing. Shaded by massive-trunked date palms, front and sides. Small front yard with a big date palm on each side of the sidewalk to the front door. Glossy-leaved shrubs in front, with big pink blossoms, a kind you see a lot of here but I never heard a name for. And quite a lot of long pine needles on the lawn from big, vine-burdened trees next door, a fairly common pine in L.A. that I suspect was introduced from Central America or Mexico.

It occurred to me that I was resisting going to the door, so I took myself by the scruff and started walking. That done, there was nothing for it but to push the doorbell. A big, strong-looking black lady answered, wearing a light green uniform, like a nurse's. I introduced myself, showing my ID, and told her I'd come to talk to Mr. and Mrs. Ashley. I figured Veronica wouldn't be there yet, and I was right. The nurse? housekeeper? also told me that Mr. Ashley didn't see anyone.

"He's looking at me right now," I answered. Dimly I could see him through a doorway behind her, in an inner room. It was unlit inside, and my eyes hadn't adjusted from the sunlight outdoors, making him look vaguely like an ape on all fours. "If Mrs. Ashley isn't home," I went on, "then I'll speak with Mr. Ashley."

I sort of pushed in, she giving way to one side, and I walked through the vestibule into a comfortable living room. Thin, leaf-filtered sunlight came through a tall south window. It jarred me to see Eldon Ashley, and to realize that this was Ashkenazi's twin. Both legs had been amputated, leaving stubs maybe eight inches long; I'd never seen anyone quite like that before. And he didn't seem to use any sort of prosthetics. He moved on his knuckles. No, on thick, blunt fingers! His torso was small, but the arms below his T-shirt sleeves were corded with muscles. His eyes were wary, and did not seem unintelligent. Brain-damaged he might be, but he looked alert and aware.

"Mr. Ashley," I said to him, "my name is Martti Seppanen." I didn't offer my hand; he was standing on his. I'm one of the stronger people that I know, but I doubt I could have held my own in a grip-down with Eldon Ashley. "I'm an investigator for the police," I went on. "I'm here because your brother Aldon was shot in his bed, night before last."

"Night . . . before . . . last?"

That's what he said. He didn't say, "Shot?" Just, "Night before last?" As if the time meant something to him. "I've been assigned to the case," I went on, then paused, trying to read his eyes. In the subdued light they could have been marbles. "Do you have any idea who'd do such a thing?"

There was a long response lag, which in his case might have been physiological instead of psychological. There was no sign of grief, but his face had kind

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of shrunk. The answer, when it came out, was "No." Quietly.

"Have you talked with your brother lately?"

He just stared blankly, saying nothing. The housekeeper/nurse came into the room then. She showed no sign of hostility, just concern, presumably for Eldon Ashley. "I've called Mrs. Ashley," she said. "She'll be here in a few minutes. It's not far."

"Right. Did you know that Mr. Ashley's brother was shot, night before last?"

She didn't looked shocked. She looked startled, then puzzled.

"Didn't you know he had a brother?"

"No sir, I didn't."

"How long have you worked here?"

"Five years last May."

"I see. Do you live on the premises?"

"I have rooms upstairs."

"Um. His brother's name is, was, Arthur Ashkenazi, but it had been Aldon Ashley." I was still talking to the housekeeper/nurse, but I was watching Eldon now. Not sure why I was doing what I was. "He changed his name after a fight, an upset, with their father," I went on. "After Mrs. Ashley, Veronica, had told their father that Aldon had said terrible things to Eldon. She'd said that Aldon was to blame for Eldon's auto wreck, that left him—" I groped. "Without his legs."

Eldon's eyes had opened wide. His mouth had opened too, not to speak, but in shock. *He never knew!* I thought. *Eldon Ashley never knew!* And then a terrible thought hit me: Maybe it hadn't happened that way. I'd had the story from Ashkenazi's old school buddy, and he'd had it from Ashkenazi, but how accurate was it? I'd laid it on Eldon without knowing for sure. If it wasn't true, I'd done a very bad thing to him, and to his wife.

The housekeeper/nurse brought me out of it. "Uh, sir, could I bring you some tea?"

I told her yes, and when she left, I asked Eldon if I could sit down. It took him a few seconds, but he said yes, so I sat. Then, using his bound-together stubs as the third point of a mobile tripod, he went to another chair and got into it with a remarkable movement that amounted to a one-armed vault, torso twisting, free hand grasping the far arm of the sturdy overstuffed. Then he settled himself in. And this was a man sixty-one years old! I curbed my gawking and made a little small-talk then, an awkward monolog.

The housekeeper came in carrying a tray, with a tea pot, two cups and saucers, tiny cream pitcher, and sugar bowl with tongs. And oatmeal cookies. There was a little side table by each large chair in the room; she served and left. I sipped and tried to think of something to say that wouldn't sound too inane. "Are you and Aldon identical twins?" I asked, then decided the question was insensitive on two counts. But after the typical long pause, he answered.

"Yes . . . identical . . . but . . . we . . . were . . . always . . . different."

He may be mentally impaired, I told myself, but he's not stupid; not across the board. I found myself saying, "Different but close, I suppose."

"Yes," Eldon said. "Close . . . stood . . . up . . . for . . . each other . . . always."

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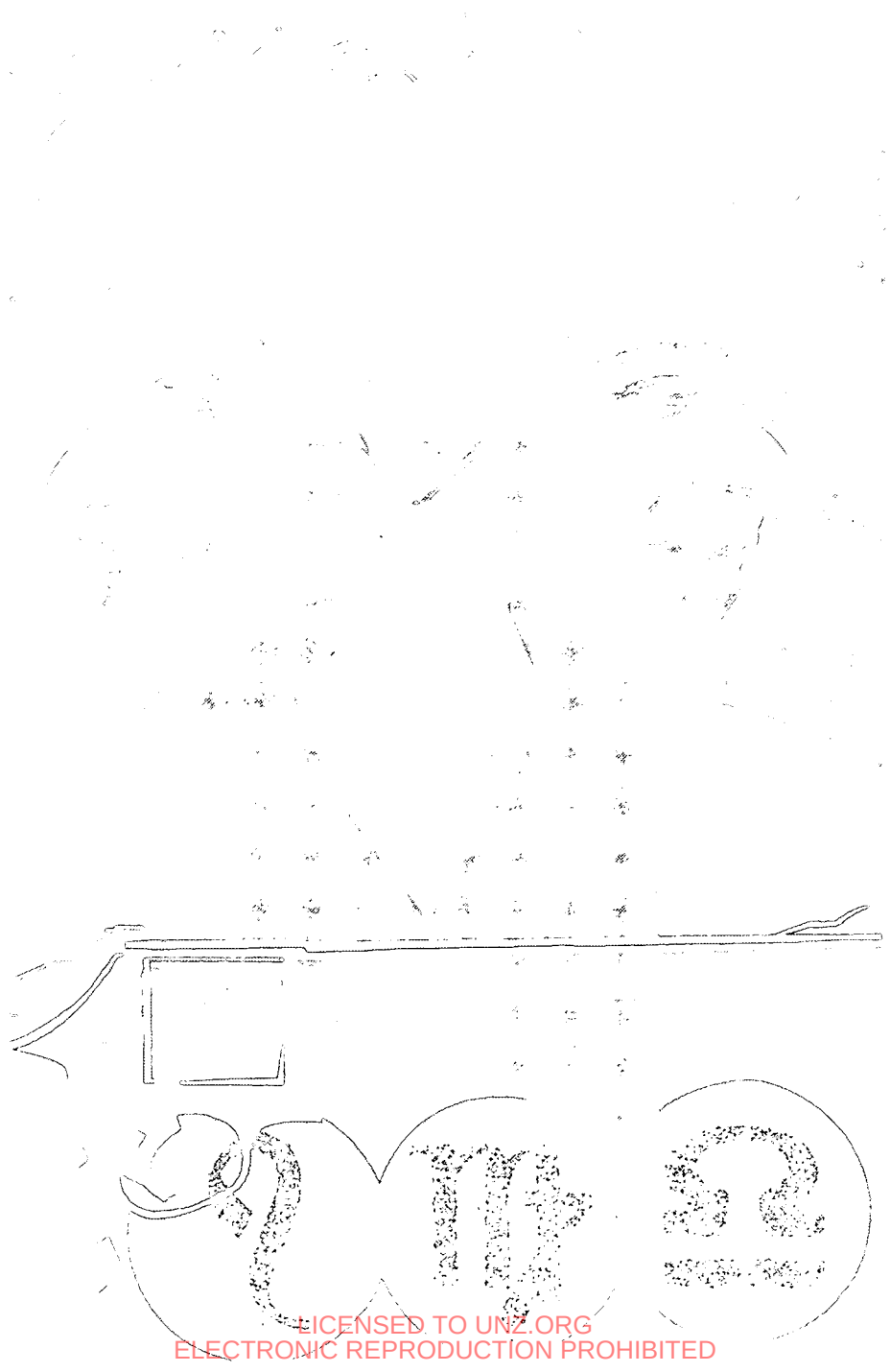

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It hurt to hear it. But he seemed OK now; not cheerful, but resigned, accepting.

Then I heard the front door open, and got to my feet. A minute later Veronica Ashley strode into the room. Her eyes moved to me like a laser; she was not pleased. "I'm Veronica Ashley," she said. Somehow accusingly. "Mr. Ashley's wife."

She wasn't a tall woman, but she had presence. Her build was sturdy, and I got the impression of someone who worked out, probably at the faculty women's health club. But the strongest impression was of will, perhaps mixed with unforgiveness. Maybe she *could* have climbed the encina with a gun, and shot Ashkenazi.

"You're also Arthur Ashkenazi's sister-in-law," I said. "My name is Martti Seppanen. I presume you've heard about your brother-in-law's death."

"Yes. I was informed by his attorney. The attorney for his estate."

"He was shot in the head," I added. "Once; right through the brain, with a silenced nine millimeter pistol.

I'd swear she was startled by that. "No," she said, "he didn't tell me that. I'd assumed—I'd assumed he'd died of natural causes."

Something felt wrong here, but I had no idea what. "I'm investigating the death for the Santa Barbara County sheriff's department," I went on. "Do you have any idea why anyone would shoot your brother-in-law?"

"None at all." Veronica Ashley was fully in control of herself now.

"Have you had any contact with him recently?"

"We haven't seen Aldon since their mother's funeral, ten years ago. And barely then."

"Not even in connection with the trust fund he set up for you? To help take care of Eldon?"

She grimaced slightly, her face darkening with blood. "Not even then. His attorney handled it."

I glanced at Eldon. He was watching intently, his mouth slightly open. His eyes were unreadable, but it seemed to me he was absorbing it all, and that it was new to him.

"But you're the payee of the fund. What do you suppose your brother-in-law was worth?"

"I have no idea."

"I don't either, Mrs. Ashley, but obviously a lot. Quite a few million, apparently." I changed direction on her then. "Perhaps you have some idea who might have killed him. Think back. These things can grow out of old grudges. Can you think of someone, perhaps from back before twenty hundred, who might have had a motive? Someone he might have seriously wronged?"

Her lips had compressed. Now she asked, "Am I a suspect, Mr.—"

"Seppanen. Detective Seppanen. Family is almost always suspect in these matters, Mrs. Ashley. That's a general rule. But I'm also looking beyond family, of course."

"Well I'm afraid I can't help you. And you can believe this or not, as you please, but I hope you catch the gunman. If for no other reason than to remove any taint of suspicion from me."

The way she said it, it felt like the truth.

I drove home with everything sort of

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rolling in my head, trying to make some sense out of stuff. And getting nowhere. Back in my apartment, I called up Tuuli. It was kind of late to ask for a date that evening, so knowing her taste for space opera (and her off a backwoods farm in Lapland!), I suggested a Star Wars festival at the New Hollywood Palladium: all the movies in one marathon night! In honor of the ninetieth year of George Mather, who'd produced the special effects for the first of the trilogy.

When I finished my pitch, she answered me in Finnish, which she doesn't do a lot because sometimes I don't understand. "Martti, that was nice of you. But what you're really looking for is a distraction from whatever's bothering you. And I don't feel like being a distraction tonight." She may have picked up that I felt abused by her answer, because then she added, "But I'd enjoy visiting on the phone awhile. Tell me about your day."

So I described it to her, pretty much the way I've described it to you—the day and last night, too. When I'd told her about getting the data on Veronica Ashley, Tuuli interrupted with: "When was she born?" When I said November 10, 1950, she laughed.

"A Scorpio! Fits like a glove. Sometimes they don't. Just a minute." I waited. After a minute she came back on. "I just looked up Veronica Ashley's horoscope in this morning's *Times*. It says that Scorpios should avoid strangers today, that they could cause them serious danger." She laughed again.

When I'd run the rest of it by her, she said I was getting close, that it would start coming together soon. Starting tomorrow, probably in the morning.

"What do you mean?"

"It's not explicit," she answered. "But a lot of things are going to simplify for you." She paused. "You might want to call Carlos this evening."

So I let her go and called him. His answering machine told me that he and Penny had gone to the New Hollywood Palladium, to the Star Wars festival. Considering the time, I must have just missed them.

It struck me as uniquely twenty-first century American: Carlos, grandson of Japanese peasant immigrants, who grew up on a hardscrabble truck farm in Otero County, Colorado; and Penny, who'd been a child on a paddy farm in the middle of the war in Viet Nam; driving downtown in a car powered basically by gravity, to sit in the New Palladium watching a digitalized and laserized renovation of a space opera classic about a war "a long time ago, in a galaxy far far away."

So what happened when I got to work in the morning? There were two messages waiting for me. One was from Carlos, telling me to see him first thing. He wasn't in yet. Then I played off the other message, from Sacramento, and shared it with Carlos when he did come in. The evening before, a patrol car had been chasing a guy for driving erratically. Finally he stopped on a bridge and threw something in the Sacramento River before they grabbed him. In his luggage they found a silencer for a 9 mm pistol, and a box of 9 mm cartridges. A magnetic sounder team then recovered a 9 mm pistol from the river, and his prints were on it. Ballistics had test-fired it, and computer-checked the

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slug against the national files. It matched the slug dug out of the floor in Ashkenazi's bedroom.

The guy's driver's license address was obsolete, but his auto registration address had been current. A search of his apartment had uncovered several hundred-dollar bills. They'd checked them for prints, and the prints included prints of Donald Pasco.

Pasco! I could hardly believe it. I mean, it's one thing to be uptight, maybe even a little crazy, about someone boosting the income of astrologists. But to have them assassinated!?

What struck Carlos most about it was that the Sacramento police had accomplished all that in one night. The result of technology, including computerization of damned near everything. And budgets that allowed a full night shift. Twenty years earlier, he said, it would have taken days, a week, and they might not have found the pistol at all.

So not only was Pasco discredited and in jail, but the murder of Arthur Ashkenazi was solved. Which should close the contracts with both the Anti-Fraud Division and Santa Barbara County, right? My problem was, I felt uncomfortable with it, and said so to Carlos.

"What do you want to do about it?" he asked me.

I had to look at that for a minute. "Well," I answered, "Sheriff Nyberg said something like: 'It's even possible that Ashkenazi could already have been dead when he was shot.' "

"If that's true," Carlos said, "then Ashkenazi died of natural causes, and Pasco's hit man was only guilty of illegal entry, illegal discharge of a firearm, mutilation of a corpse, and maybe attempted murder. You should let Sacramento know what Nyberg told you."

I nodded. If that was what had been bothering me, then what Carlos said should have made me feel better about it. But it didn't. I told him that, too.

"So what do you want to do?" he said. "Under the circumstances, we can't keep these contracts open, charging your time and expenses to them. Not when the only justification is that you don't feel good about it."

I nodded. "It's the viral meningitis I'm hung up on," I told him. "So close the Anti-Fraud contract, but keep the Santa Barbara one open for another hour or so—to authorize and cover the costs of some calls and maybe some data accessing."

Carlos's eyebrows lifted. "I take it you feel OK now?" he asked. I said I did, and he left without asking any more questions. Then I got on the line to Sacramento again, this time to the California Department of Health Services. Specifically to the chief of Vector Biology and Control. No, she said, there hadn't been another reported case of viral meningitis, except for Ashkenazi's. Not anywhere in North America, and as far as she knew, in the world, for ten years. And "remarkably," as the lady put it, they hadn't succeeded in establishing a colony of Ashkenazi's virus on human tissue cultures. Considering its swift development in Arthur Ashkenazi, and its seemingly close identity with the EVM virus, they'd found that hard to accept. Hard enough that they'd repeated their attempts, this

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time being very careful to do everything just right.

"How do you explain something like that?" I asked her.

Her image shrugged on the screen. "I don't. I'm having to call it a non-infectious virus, and describe its infecting Mr. Ashkenazi as an unexplained anomaly. But we're taking no chances with it."

I thanked her and hung up, then told Carlos about it. "Maybe, just maybe, I can find the explanation. Can you come up with a contract that'll pay for it?"

He leaned back in his old, tilt-seat swivel chair. "Martti, considering the god-unlikely stuff you've pulled off before, I'd really like to. And if I could, I suspect Joe would go along with it. But with no more to go on than you just gave me, there's no way.

"Now if you want to do it on your own time, I'll tell you what I can do. Keep track of your time and expenses, and if you come up with something that'll justify pitching a contract to—who? Vectors and Control?"

I nodded.

"If you can do that, we'll pitch it to them. And if we get a contract, we'll charge them retroactively for your time and expenses. There's legal precedent for it, and right now your stock is high."

I called back Vector Biology and Control and asked if they planned to keep the virus. The lady said absolutely; they had it on file in a freezer. Something as weird as that, they'd definitely not discard. I told her I was involved in the Ashkenazi case, and had a data trail that might lead to an explanation. Admittedly I exaggerated, but it would set her up, in case we hit her later with a contract request.

Next I called the West L.A. Station of the LAPD and got the name of a restaurant—Peri's Cafe—favored by their people for private, one-on-one meetings. According to Lieutenant MacNab, the food wasn't much and it didn't do a lot of business, but they had booths that gave maximum privacy.

Finally I called the genetics lab at UCLA and asked to talk to the director. The receptionist asked what I wanted to talk to him about, and when I said that was a matter for him and me, she said Mr. Chatterjee didn't accept phone calls on that basis. When I told her it was a legal matter though, she put me through. I suspected she might be listening in, so I told Chatterjee I was an investigator for the state, and we very much needed his expertise.

It appealed to his sense of professional pride and importance, so he gave me a one o'clock appointment for lunch, and suggested a faculty dining room. Still suspecting a snoopy receptionist, I told him I'd meet him there, and how he could recognize me. I was pretty sure I'd recognize him, with a high-caste Hindu name like his.

On campus I parked in a restricted faculty lot and met him as agreed. I showed him my ID, and told him that actually I needed to talk somewhere more private. He went for it, intrigued now by the sense of secrecy. At Peri's, after we'd gotten menus and a pot of tea, I looked around and said in a low voice: "Doctor, what I'm going to tell you is strictly confidential. I'm working on a very tough case, one that's secret

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and highly sensitive." Then I told Chatterjee about the viral meningitis, including Vector Biology's inability to culture it.

"First though—years ago I read that the viruses which caused the Great Flu and EVM, maybe even the AIDS virus, might have been engineered. In your opinion, is that possible?"

He answered in a voice as quiet as mine had been. "Many things are possible today," he said. "Thirty years ago, when AIDS first appeared, genetic engineering was quite primitive. But yes, even the AIDS virus could conceivably have been engineered—crudely but effectively. The possibilities are greater for the Great Flu and EVM; genetic engineering had advanced considerably by then.

"On the other hand, there's no need to appeal to genetic engineering to explain them. Devastating pandemics have occurred throughout history without humans engineering them."

I said nothing to that for a moment, just looked intently at him, setting him up. "Dr. Chatterjee, could a virus be engineered that can infect only one person?"

It took him a minute to answer. "Theoretically, yes. You are familiar with killer bees, of course."

"I've read about them, and saw a special on them once. I guess everyone has."

"Then you may be aware that what people call killer bees are not the same insect imported into South America half a century ago. What we have today, especially in the United States, is fundamentally the domestic honey bee, *Apis mellis*, but with certain genes of the African bee. The queen, whether, domestic or African, breeds only once, on her maiden flight, and stores enough semen in her body to lay fertile eggs throughout her productive life. And if, on her maiden flight, male bees with the genes for aggressiveness are in the vicinity, there's a strong likelihood that they will breed with her. And because the males are haploid, every sperm will have those genes.

"The consequent mixed genome then succeeds or not, depending on . . . Well, we don't need to go into all that. Suffice it to say that highly aggressive so-called killer bees have pretty much taken over from the mild-mannered domestic bees as far north as southwestern British Columbia, and in the midwest and east, into Nebraska and Massachusetts. And pretty much destroyed the honey industry, while at the same time badly harming orchardists.

"Loosely speaking, the killer bees we have here in the United States are a sort of hybrid—an introgressed form of *Apis mellis*—but about as dangerous as the original African bees.

"However, earlier this year, Marvin Schlosser, a geneticist at Stanford, succeeded in tailor-making a disease that should eliminate the killer bee genes from the Americas. He started with an old, endemic viral disease of the domestic bee, one that's been around for as long as anyone knows. And created a genetic compound in the virus that makes it far more virulent than the normal virus. *But only for bees with a certain group of genes*, the genes for aggressiveness that make bees killer bees. In a few years it will probably have killed all the bees south of Ne-

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braska, but we can then reintroduce the normal, gentle *Apis mellis* from farther north, into areas where the tainted populations are destroyed."

I was beginning to feel excited. "How difficult is it to do something like that?"

"Now that it's been done once, it should not be so difficult, assuming you have a properly equipped lab and the necessary skills. First Schlosser engineered a viral genome that was totally non-virulant. Actually, as it turned out, that step was the most time-consuming. Then he tailored a selected low-grade virulence for genomes that included certain genes which we can call the killer genes. With that accomplished, he altered *that* virus for an extreme virulence which worked slowly enough that infected bees will be able to spread the virus before succumbing to it. It will be released extensively next spring."

"I see," I said. "And other geneticists can simply adapt his procedures to solve other problems."

"That is correct. Schlosser's work has been published, and of course, a fully detailed description of it is available through the virological, medical, and entomological computer networks, as well as the genetics network. I had our laboratory make a printout and circulate it for everyone's perusal and initials; the work is that important."

"Umm. And could a virus be tailormade to infect a single specific human being and no other?"

Chatterjee looked at that for a minute, too. "Theoretically, yes. But to make it specific to one person, it would probably be simplest, certainly safest, to key the virus to that person's total genome, which is unique to him. And to his identical twin, if he has one. It would seem to be impossible, unless you could work with diploid material from that particular person."

"Such as?"

"Hair would suffice."

"Or hair from that person's twin?"

"Identical twin, yes."

It was looking more and more as if this was the right track. I needed to stay with it, nail down the steps, not missing any. "If," I said, "a meningitis virus was designed to kill Arthur Ashkenazi and only Arthur Ashkenazi, I suppose they'd have started with the EVM virus. Correct?"

For just a moment his eyes widened. Up till then we'd been talking bees and hypothetical humans; now we were down to cases. "Probably not," he answered. "There is something available that would make the work much quicker and easier. If the designer had diploid material from Mr. Ashkenazi.

"The EVM epidemic simply ran itself out, you know. It is not known why, but historically epidemics have done that eventually. The Great Flu and the various outbreaks of the Black Death are other samples. Meanwhile, researchers all over the world had been working desperately to develop a vaccine. And finally succeeded. If EVM should now recur in some genetic variant or other, there exists a non-infectious, non-virulant genetic form with which people can safely be inoculated; unless they happen to have an allergic reaction. A form which will give them immunity without even a mild fever. Also, it can be taken orally.

"Thus if someone wished to tailor a

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virulant form, one would best start with the vaccine. A major part of the work has already been accomplished."

Something else occurred to me then. "How long would it take to do it?"

"It is difficult to say. Three months perhaps. Or possibly as little as two weeks, considering that one would be designing it for a complete genome. Also, one would not have to go through the steps of designing a low-level virulence and then modifying it for a greater. So let us say ten to thirty days.

"Who'd have access to the vaccine?"

"Many persons. Surely almost any principal hospital must have a stock on hand, and I'd be exceedingly surprised if there is not a supply here at the medical center. They are sure to have an abundance of it at the Office of Vector Biology and Control in Sacramento."

"Who'd have access to the supply in the med center here?"

"Assuming they have it, probably many persons. Numerous materials must be stored in their freezers, and presumably quite a number of persons go in and out. How many of them would know where the vaccine is stored is another matter."

"Right," I said. "Dr. Chatterjee, thank you very much. You've given me food for serious thought. And remember sir, it's important that you don't mention our talk to anyone. Not to your friends, your wife, or any member of your staff."

For just a moment I thought of telling him who, specifically, I was interested in—Veronica Ashley. That she was Ashkenazi's sister-in-law, and that her husband, Ashkenazi's identical twin, was the presumptive heir to his millions. It would make the importance of silence more real to him and reduce the chance of a leak.

I decided not to. Veronica Ashley was only a suspect. I felt reasonably sure she was guilty, but the evidence was circumstantial. And I'd been wrong before. It wasn't ethical to talk about a suspect to her associates, least of all her boss, without a compelling reason, and this didn't feel that compelling.

So I drove him back to his office, then made a call on my car phone to the UCLA Medical Center, got connected to Medical Supplies, and talked to the man in charge. At 9 P.M. that night he let me in the freezer room where the EVM vaccine was kept. I took print masters off the drawer and the flasks with the vaccine. The next day our lab sorted out the prints, but none of them matched Veronica Ashley's prints in the national print archives. Of course, she could have used plastic gloves, though I wouldn't have expected her to.

So all I had was an ingenious theory without hard evidence to back it up. And no idea where to turn next. Reluctantly I told myself it looked like I'd have to give up, something I really hated to do. I went to Carlos's office and ran it all by him, hoping he'd see something I'd missed, but he didn't. I told him I'd be ready for a new assignment the next day.

Then I called Tuuli and told her answering machine I wanted to take her out for Mexican food that evening. I'd be at her place at five in case she was agreeable; that way we'd beat the supper rush. From there I went to the club and worked out for the first time since Mon-

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day, extra hard to make up for the calories I intended to take on that evening. Then I went home for a nap.

About the only satisfaction I had that day was in my car, listening to KFWB News Radio. It reported that Arthur Ashkenazi's will had left the bulk of his estate to the Hypernumbers Institute, pretty much a psychic-oriented group, for research into the multidimensional nature of reality. Veronica Ashley would be fit to kill.

It was getting dark when Tuuli and I got back from Casa de Herreras. I felt stuffed. There was a parking place made to order, right in front of her building, and I grabbed it. Then, instead of going up to her apartment, we sat there for a few minutes in a weird, silent mood, watching the dusk thicken.

"I don't think you'd better come up tonight," she said at last.

I got out, went around and opened the off-side door for her. She looked worried. "I mean it," she said.

"What's the matter?"

"I'm not sure, but . . . something doesn't feel right."

I reached to help her out. "I'll just walk you to your door and leave," I told her. We walked up the sidewalk between her building and the thick, two-meter high hedge that bordered the property. A year earlier, trashers had torn the hedge all to hell. After clipping back, it had grown up thicker than ever in one year. Southern California!

There was night jasmine around somewhere that made the evening rich with a smell that reminded me of lilac back in Michigan, but heavier and sweeter. Night jasmine's one of the things I love about L.A.

Tuuli's apartment was on the second floor, front corner. Typical of Los Angeles, the steps were outside, leading to an outside second-floor walkway. I opened the screen, intending to hold it for her while she unlocked her door.

There was a "chuff!" and a bullet clunged like a hammer on an ornamental wrought iron upright from the walkway railing to the overhang. A fragment bit my cheek. I threw Tuuli sprawling to the deck, then vaulted over the railing, hearing another "chuff" as I did so, the sound of a silenced pistol. I landed on the hedge below, half scrambling and half falling off it onto the sidewalk. A third shot chuffed, and I heard the slug spending its energy clipping hedge stems, as I scrabbled to my feet and headed for the street and my car. I got there panting more from excitement then exertion, fumbled the key into the lock, and snatched my pistol out of the door pocket.

The shots had come from the building next door, and I couldn't make up my mind whether to go there, or back to the second-floor walkway of Tuuli's. While I crouched there trying to make up my mind, her front window opened.

"Martti!" she called softly. "Stay there! I'm all right. I'll call the police."

I didn't stay there, though. I went back to the stairs, under cover of the hedge, and crouched there listening, in case whoever it was came over. Although I really knew he wouldn't. It was me he'd been after, and having blown his opportunity, he'd have taken off. Maybe to set another ambush at my place.

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Things were still as midnight. We hadn't made enough noise to arouse people. I had no idea who the gunman might be. In my business you offend some people who might take a notion to exercise their grudges like this. I knew that the hard way. And while most of them end up domiciled with the state for extended periods, some would be running around loose.

Two or three minutes later the police arrived, and after the identifications were handled, we went next door together. There was a sign in front:

APTS FOR RENT
1 & 2 BDRMS
SEE MGR
9 A.M–7 P.M.

We went up the stairs two at a time, and along the second-floor walkway on the side facing Tuuli's. The drapes were open wide in one apartment, the window was open, there was a hole in the screen, and it was dark inside. One of the officers went and got the manager.

All we found interesting inside were three empty cartridge cases, 9 mm magnum; I was darned lucky he hadn't hit me. By that time another police car had arrived, this one with a senior sergeant. I went back down with the first officers, got into my car, and they followed me home, staying close, on the chance that the gunman might try for me again.

My apartment's in a security building with a basement garage. They sat waiting and ready in the patrol car while I stopped on the ramp to insert my key card into the slot, to open the door. As I did, it seemed to me that there was someone crouched in the tall shrubs not ten feet away. Though I couldn't be sure, it was so damned dark in there. The door slid aside. I rolled in and keyed my short wave to the police channel while the door slid smoothly shut behind me.

"Car 1094," I said, "I think our man's in the shrubs just to the left of the ramp." Then, pistol in hand, I got out and reopened the garage door from the inside. I'm not sure whether they needed me or not. They'd both gotten out of their car and moved on the shrubs from two angles, while I stood on the ramp with my .38 pointed into the shrubbery. He was there all right. He raised both hands and surrendered.

They took me with them to the Hollywood Station on Wilcox, where they questioned him and me both. I answered everything they asked. The gunman told them only his name; said he'd gone into the shrubbery to take a leak. He looked part Afro, part Oriental—Korean, judging by his middle name, which was Suk. Harley Suk O'Connell. The police knew him. He was reputedly a free-lance hit man who did occasional jobs for the black mafia. So far as I knew, I told them, I'd made no enemies there. We had investigators who might have, but not me.

When they were done, I talked in the hall with the sergeant on the case. Someone must have paid O'Connell to try for me, I said. If they checked out his pad, they might find some cash in large denomination bills, and the bills could have some useful prints on them. He agreed that that might be worthwhile.

Then I left. I dialed Tuuli on my car phone to tell her what had happened and that I was OK. She'd been waiting for me to call, and worrying because I

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hadn't. She told me to come right over; I'd been hoping she would. I was back in front of her place in ten minutes; she was watching out her window, and met me at the door with her hat on and her purse in hand. In the purse, I was willing to bet, was the small, pearl-handled 7 mm pistol she kept in her bed-table drawer.

It's just a few blocks from her place to Laurel Canyon. Laurel Canyon Boulevard crosses the Santa Monica Mountains, a range of high rugged hills that divides Los Angeles into the L.A. Basin to the south and the San Fernando Valley to the north. From Laurel Canyon, narrow residential streets zigzag their way up among the slopes and draws. I drove without either of us saying anything. Finally I parked at a place we like, on a crest overlooking the basin. There's a tiny strip of park there, with benches. It's not the safest-looking place to sit in the dark, but we weren't worried. There's a patrol along there to discourage trashers, and besides, Tuuli had a gun in her purse and I had one under my left arm.

Since the internal combustion engine was banished by the geogravitic power converter and the air protection laws that followed, you can see forever from up there, a vast sea of city lights. To the south is a big, virtually unlighted area that I've always assumed must be a golf course; and more miles to the south, the thick flow of headlights and taillights on the Santa Monica Freeway. A lot of miles and billions of lights farther rose the hills of the Palos Verdes peninsula, sparkling in white, red, green, and blue. Amazing that you can see individual lights so far away! And over all loomed scattered tall clouds side-lit by the city. It's one of the most beautiful sights in the world, another reason I love L.A.

I reached over, took Tuuli's hand, and for maybe the dozenth time asked her to marry me. She leaned against me and kissed me and said she loved me, but no, she wasn't ready to marry; might never be. If that changed, she said, I'd be the first to know.

How could I argue with her? After a little bit I took her home, and she invited me up.

The next day I took some compensatory time off and slept till after ten. Then I called the Hollywood Station to see if they'd learned anything more about O'Connell's hit attempt on me. They had. They'd found bundles of hundred-dollar bills in O'Connell's apartment. Among the prints they took were some that belonged to Veronica Ashley. They planned to question her.

I asked them if they'd hold off on that, that it might be a lead on a case we were contracted for by the Santa Barbara County Sheriff. That wasn't strictly true, not any longer it wasn't, but they took my word for it, and said they'd hold off. They really had nothing to charge her with anyway, with the evidence they had. All they had O'Connell for was loitering, carrying a concealed weapon, and possession of an unregistered firearm. With his record, that could put him away for maybe three years, two with good behavior, but he could do that standing on his hands.

Why would Veronica have put a contract on me? I'd offended her all right, but what had I said or done that might have scared her? I called up the data on

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her from my files—I needed to erase it soon—and stared at it. Veronica Ashley, née Pipolli.

Then it hit me. *Pipolli. Piper.* Could be. I called the data center again, using the Santa Barbara County contract, which their files still showed as active, and accessed Dairy Delite in Ventura. The franchise holder was Francis Gustavo Pipolli, aka Piper. His records gave his father's name, and his father's records showed *his* father's, and his showed a daughter, Veronica. Veronica Ashley was Piper's only paternal aunt.

Something else struck me then, too. Something I'd missed before and shouldn't have: GTE's computer records indicate when a call was made from a pay phone; the call to Ashkenazi hadn't been. She had to have called from her nephew's office, so he probably knew what she was up to. I'd said something to him about "poisoner and poisonee" and he would have called and warned Veronica.

I laid it all out for Carlos, and he said go for it. He'd take it up with Vector Biology right away, and if they wouldn't spring for a contract, the firm would cover the cost and use the case for publicity. Assuming it worked out.

Carlos didn't ask me what I was going to do next, and I didn't volunteer it. I spent most of the day catching up on odds and ends, and working on my Spanish. Then, with my Pocket-Pak recorder inside my jacket, next to my gun, I headed for Westwood to confront Veronica Pipolli Ashley. I'd start dumping my circumstantial evidence on her—it might even be enough to go to court with now—and maybe she'd start saying things.

Assuming she was home, of course.

She was at home, and unfriendly. When the housekeeper announced me, Veronica walked into the living room like a drill sergeant. Eldon came swinging in too, on his fingers and stumps, somehow looking more formidable than a lot of guys with legs. I started by telling her that Harley O'Connell botched his contract and the LAPD had him in jail. Sarcastically she said that that sounded nice, and who was Harley O'Connors?

I matched her tone; sarcasm can get people to say things they otherwise wouldn't. "O'Connell," I said, "not O'Connors. I thought you knew him. Or do you give bundles of hundred dollar bills to people you don't know? Or is there something new in the world: two people with the same fingerprints? O'Connell had three shots at me, incidentally, and all I got was a fragment in the cheek."

I touched my face as I said it, my eyes on hers. She was showing no fear; what I was looking at was suppressed rage.

"The fingerprints weren't your only mistake," I went on. "That was stupid, using your nephew's phone to set up the date with Arthur—with Aldon that is. Why didn't you use the pay phone?"

With that her face turned white, but she didn't look faint at all. The muscles in her jaw lumped like walnuts.

"Was that when you hired O'Connell to kill me?" I asked. "After I talked with Frank? The timing's about right. It would have taken O'Connell awhile to establish my routines, such as they are, and decide a good time and place to try his hit."

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She still was saying nothing, so I went on to my next shot. "They've decided that Aldon was dead before he was shot," I lied. "I'd never have figured out how you killed Aldon," I went on, "if I hadn't heard about the killer bee research. Do you keep some of the meningitis virus around the house? Maybe you plan to use it on your husband next."

That broke her control. *"Get out!"* she shouted suddenly. *"Get out of this house! Now!"*

I shook my head. "Not without the rest of the virus."

"All right!" she shouted, *"I'll give it to you!"*

And stomped out of the room. For the first time that day I turned my attention to Eldon. He was in a state of shock. In ten seconds Veronica was back. But what she had in her hand wasn't a flask or vial or petri plate, it was a snub-nosed pistol, 8.1 mm but it looked bigger, because it was pointed straight at me. All that saved me from getting shot was, she was too damned mad to simply kill me. She was going to blast me with venom first, with words.

Before she got any of them out though, Eldon was between us, facing her. I wished he was taller. "You . . . killed . . . Aldon," he said. "And . . . you . . . lied . . . about . . . him . . . to . . . father. . . . How . . . could . . . you . . . do . . . that? . . . You . . . said . . . you . . . loved . . . me."

The steel and the steam went out of Veronica Ashley as if they'd never been. "I do love you, Eldon," she said, and watching her, I was sure she meant it. "I love you very much. I've always loved you."

"No," he said, and moved toward her on splayed and callused fingers. "You . . . can't . . . love . . . me. . . . You . . . killed . . . Aldon." Then he launched himself at her, I'm not sure just how, tackling her, scrambling all over her. I ducked out of the room and drew my own gun. She screamed, and her gun went off, once, and after a couple of seconds later a second time. Crouched and ready, I looked back in.

Veronica Ashley sat on the floor against a heavy chair, weeping quietly, holding her hands to her belly. Her face was already gray. Sprawled on the floor was Eldon, his head a ruin, far worse than Aldon's had been. He'd gotten the gun away from her and gut-shot her, then put the barrel in his mouth and pulled the trigger. Her eyes moved to me when I stepped into the room, the hatred gone from them, replaced by shock and something else. Grief.

"Jesus," I said to her. "Jesus, Veronica, I'm sorry. I'm really really sorry." And I meant it.

It was all on the record cube. At the hospital the next day, Veronica Ashley told everything. And of course the newspapers picked it up. They loved it. They gave Prudential a lot of good publicity and made me sound like Sherlock Holmes. So of course I got promoted; I don't wear *junior* in front of *investigator* anymore.

I figured it would get a lot of publicity, but I didn't realize how much. As a matter of policy, I called Carlos from the Ashley's, as soon as I'd called the police. When I'd told him what hap-

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pened, he said come to the office as soon as I possibly could. When I got there, he was waiting with Joe. In my profession it's best not to have your face on the six o'clock news, so Joe gave me a paid vacation as a bonus, and sent me to his place to hide till I could leave town the next day. I phoned Tuuli from there, and she surprised me: she agreed to go with me!

I left Joe's at 4:30 the next morning, picked her up, and we flew to Hemlock Harbor, back in Ojibwa County, Michigan. Where she met my sister Elvi and my half-brother Sulo. Sulo's more than old enough to be my father. Both of them loved Tuuli right away. Now she and I are roughing it in dad's old fishing shack, his *hytti*, back in the bush on Balsam Lake, where I taped this because Elvi said I owe it to my nephews and nieces, and whatever children Tuuli and I might have.

Yep. Tuuli agreed to marry me. I'll have to improve my Finnish, though, she says, speak it as well as Elvi, or even Sulo. We'll go back to L.A. and find a security building in a good location. One where she can rent an efficiency apartment in the same building we live in, for her consulting work.

That's about all there is to the story, so I'll end off and go split some wood for the cook stove. I'm not missing L.A. too much yet. ■

●The English-speaking world may be divided into (1) those who neither know nor care what a split infinitive is; (2) those who do not know, but care very much; (3) those who know & condemn; (4) those who know & approve; & (5) those who know and distinguish. Those who neither know nor care are the vast majority, & are a happy folk, to be envied by most of the minority classes.

H. W. Fowler

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the reference library

By Tom Easton

Kaduna Memories, Jack McKinney, Ballantine/Del Rey, $4.95, 250 pp.
Heathern, Jack Womack, TOR, $16.95, 215 pp.
Children of the Shroud, Garfield Reeves-Stevens, Popular Library, $?, 325 pp.
The Race for God, Brian Herbert, Ace, $4.50, 295 pp.
Voyage of the Star Wolf, David Gerrold, Bantam, $4.50, 276 pp.
The Child Garden, Geoff Ryman, St. Martin's, $19.95, 389 pp.
20/20 Vision, Pamela West, Ballantine/Del Rey, $3.95, 230 pp.
The Others, Margaret Wender Bonanno, St. Martin's, $19.95, 370 pp.
Heartlight, T. A. Barron, Philomel, $15.95, 272 pp.

As Jack McKinney's **Kaduna Memories** begins, humanity is embarked in earnest on the seas of space, and an exploratory ship, the *Excalibur*, is approaching the asteroids. There they find an alien ship stranded by the failure of its faster-than-light drive and crewed by aliens who promptly go into stasis when frightened but are otherwise fairly convincing. The explorers bring one alien home with them and are promptly "disappeared" by their scheming corporate boss, Emeric Bulkroad, head of Offworld Lifting and Development, who then pumps the alien for every technological gimmick he can. In this he has the aid of Rec, the first true artificial intelligence. Sadly, Rec will be destroyed later on in order to keep the alien secret.

Fifteen years later, OLD's stolen technology has led to a form of cyberspace, among other things. Felix McTurk is a private data detective specializing in tracking mislaid bill payments, and the like, through cyberspace with the aid of several teenaged computer wizards. Beset by bills of his own, he accepts a strange client and finds that his

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help leads immediately to computer chaos on an unprecedented scale. Meanwhile, Jain Nugget, the daughter of two of the *Excalibur*'s scientists, raised by Bulkroad after her parents supposedly died, has been told by the AI that runs the Bulkroad kitchen that her parents may actually be alive. She must find a Dr. Nerbu to learn more.

To fulfill her quest, she winds up engaging Felix's services. Together, the pair watch as the strange client trashes another computer system. They are inexplicably rescued from strange thugs by robots. They learn what Nerbu can tell them. They lead the strange client to the Bulkroad Earthside mansion, where another computer trashing produces a high-society pie fight, of all things. Eventually, the dead rise, the aliens are freed, and Felix, who once worked for OLD but was fired for trying to use his computer skills to keep the company from screwing him, gets his revenge.

It's active, sometimes funny, and well enough done to hold your interest.

The world of Jack Womack's **Heathern** is a near future when the US has gone through a time of near disintegration, meaning economic collapse, insurrection, guerrilla warfare, and general chaos. Into the gap has stepped the Dryden Corporation, headed by Thatcher and Susie Dryden, one-time drug smugglers who used their ill-gotten gains to establish a toehold in the world of corporate legitimacy. Come the collapse, and they used their money to buy into everything in sight. Now people live and die at their whim. The Army occupies Manhattan and fights a war against Long Island. They virtually own the nation, cutting treaties with Japan and plotting world domination.

The story's narrator, Joanna, is a Dryden executive nominally in charge of new projects. Through her eyes, Womack displays the Drydens, especially Thatcher, as megalomaniacs whose self-centered ambitions know no bounds. They have a new project for Joanna, a man who teaches poor children and has a reputation as a miracle-worker and prophet. Lester Macaffrey is, perhaps, a messiah. And if the Corporation could just enlist such an individual to hand out messages and perform miracles that support its ends, why, there would be no limit to the Dryden power!

Perhaps not so oddly, Macaffrey is willing to talk to the Drydens and, when his school is closed down, to sign on. He and Joanna become friends. As they get to know each other, we learn that Thatcher Dryden is the sort of hypocrite who, though he is against abortion, can kill Joanna's newborn son by him as a potential competitor. He is indeed the "heathern" of the title.[1] We can also take him as a Herod figure, so that when we realize that Macaffrey's miracles seem to gain more than a little from Joanna's presence, the ending is less surprising than Womack may have intended.

Womack's style, though it draws plaudits from TOR's blurb writer (who calls it "Hip, literate, polished"), struck me as detracting from his story. His dialog especially sounds pretentious, as in this example: "As so many these days are mad for apocalypse no matter how arbitrarily timed, more outré stories have begun to circulate, silly even by Nasty Nineties standards and far beyond most recent fin-de-sieclevities—". Yet *Heathern* remains an intensely emotive tale of evil seen through the eyes of innocence.

* * *

[1] A southern mispronunciation of "heathen."

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Garfield Reeves-Stevens's **Children of the Shroud** is in a way a triumph of the imagineer's art. It begins by showing the reader a number of strange teenaged boys: James is in a psychiatric ward, apparently because he stabbed his parents though they were dead first; he was trying to cover up that they died because he *told* them to. El Nino is busily forging an alliance of city gangs, persuading by killing and resurrecting a buddy; when he does this in front of a spying swat team, he denies the cops the evidence of murder and drives detective Burch into attempting an assassination, much to the dismay of rookie Jim Hyams. Juan is a crippled healer. John levitates. All expect the imminent arrival of a "dream friend."

Self-styled psychic Barbara-Jane Fuller has a vision of Armageddon involving the President. Susan Foster, a science writer dying of cancer, is invited by an old friend, Catholic Father Panati, to help out on a panel investigating some new wrinkle in biological technology; her quick mind promptly penetrates the smoke screen to see that the issue is cloning and to force Panati to reveal all: A scientist, just before committing suicide, confessed to another priest that he had taken cells from the Shroud of Turin and cloned thirty copies of Jesus Christ.

My reaction at this point was not mild. "Hogwash!" I cried. "Ridiculous! No way!" That is, I found it just a little difficult to suspend my disbelief. But I did keep reading, and in due time I was rewarded by Reeves-Stevens's triumph: The author actually does make his unlikely premise make sense, at least enough to justify the story. And, of course, the clones are those teenaged boys, each with one or more christly powers. Are they all the sons of God? Does their humanity demonstrate that Jesus was just a strangely empowered human being? Or are they, since they cannot be *the* son of God, Antichrists? What does Reeves-Stevens's notion do to the conventional ideas of Christ?

You can imagine how uncomfortable the situation has to make Father Panati, good Catholic that he is. But now meet Bobby-Jay, a remarkably venal TV evangelist, a fundamentalist believer in the Rapture and the last days who has spies everywhere. He learns of the Fuller vision and the cloning, and he of course sees Antichrists and the fulfillment of the book of Revelations. He contacts the President, who has fundamentalist leanings, and with Fuller convinces him that the time has come to launch a preemptive strike against the satanic communists. He also starts collecting the boys and tormenting them. His kidnappings draw the attention of Foster and Hyams, who with the still free clones plot a rescue.

And events barrel on down the hill toward the brink of nuclear holocaust, the comeuppance of religion, the arrival of the dream friend, and a very hopeful ending. Despite the bushwah, despite the strain on our credulity, *Children of the Shroud* winds up a remarkably satisfying effort.

In the excessively didactic **The Race for God,** Brian Herbert conceals our present reality behind a thin veil of renamings—the world is D'urth; the Bible is the Babul; Christianity is Krassianism; and so—to hand religion a few more lumps. The central character is Evander Harold McMurtrey, founder and Grand Exalted Rooster of the tongue-in-cheek Interplanetary Church of Cosmic Chickenhood whose chief ritual utterance is "O Chubby Mother, Let me rubba your belly . . . " One morning, he awakens to the voice of God inform-

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ing him that He dwells on the world of Tananius-Ofo in the distant galaxy 722C12009 and He is inviting visitors. A host of strange spaceships soon appears in McMurtrey's town, and the faithful of many faiths gather for the journey. In due time, they figure out how to open the ships and board. And they are off. With them goes Jin, a "cyberoo," or indestructible cyborg, from the Bureau of Loyalty, out to destroy anything and everything that competes with allegiance to the state, as represented by its masters.

Not surprisingly, the book is dominated by prolonged discussions of the nature of God and the relative merits of the various religions. The arguments grow violent at times, but even this is not enough to maintain the reader's interest beyond the charm of the initial premise. Nor are the admissions of divine fallibility and finitude at the end of the tale enough to make one feel that getting there was worth the effort.

Indeed, one even feels cheated, as if the book were cut off a chapter early. Herbert tracks the deadly career of the cyberoo with loving detail right up to his destruction by falling down a cliff on Tananius-Ofo, describes Jin's reassembly from the resulting paste, and says Jim is climbing back up the cliff toward the cave in which God and the surviving pilgrims are chatting. He tells us to expect attack and battle and perhaps an end to divinity and divine plans. And there Herbert drops the issue, leaving the reader wondering why such a significant loose end was not tucked in or snipped off. If the loose end belonged to a stouter thread, I would suspect a sequel. As in, the story seems quite definitely finished, except for the missing chapter.

David Gerrold's **Voyage of the Star Wolf** is a tale of intense frustration and terror that delivers a lesson or two in leadership. In Gerrold's future, the stars are dominated by two human cultures, that of the Alliance of ordinary humans and that of the Morthans, genetically engineered superhumans who have convinced themselves of their superiority to the rest of us (they are "more than" human) and established their own bloody-mindedly militaristic worlds. War is brewing, and the new warship LS-1187, complete with its "Harlie" artificial intelligence, has just joined the armada formed to protect the Silk Road Convoy, a caravan of merchant ships. The LS-1187's captain has the motto, "Never lie to the crew," and his executive officer, Thomas Korie, tries very hard to be a democratic nice guy. But as the LS-1187 comes out of hyperspace, the Morthans attack, shred the armada and the convoy, and damage the ship. The captain is dead. Korie must get the ship through a long period of lying doggo and a confrontation with a Morthan superdreadnaught and get it back to base for repair. But when he finally makes it home, he finds himself, his ship, and his crew in disgrace, blamed for leading the Morthans to the fleet. Korie will *not* be promoted to replace the dead captain.

Morale suffers, and democratic, participatory leadership doesn't help. In due time, a new captain appears. His nickname is the Star Wolf, and he is one stern, uncompromising, mean son of a bitch. He teaches Korie how to be likewise, morale improves, the ship is finally repaired, and then they are off on another mission, this time to meet a courier that has used a new high-speed drive to penetrate the Morthan realm and—supposedly—pick up a Morthan diplomat bearing peace overtures. But when they find the courier, it is dead in space and the Morthan is the only

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living thing aboard: It has killed and eaten all the crew; it itself does not seem to be killable or containable, and it seems quite obviously intent on destroying Korie and his people and capturing the new drive for the Morthans.

In the nature of such stories, the Star Wolf must be taken out of action and Korie must show his stuff by defeating the foe and saving the drive. How he does so, despite the considerable obstacles Gerrold puts in his way, is the stuff of thrillers. The lesson, that lying can be essential to effective leadership and morale, may be pragmatically apt but it does strike me as too trivial to justify the attention Gerrold paid it.

Still, the adventure's there, the action moves along nicely, and the villain is as nasty as anyone could wish. If you can ignore the didactic tone, which seems to say, "Listen up, Kiddies! This is important stuff!" you'll enjoy the tale.

Geoff Ryman's **The Child Garden** is a marvelously, absorbingly evocative work of high imagination. It is so literarily ambitious that it is a wonder that it succeeds as well as it does. And it is well worth the reading.

The premise is that some time in the not too distant future, viral cancers will become a flourishing plague. A cure will be found, a way to protect human genes against the changes that lead to cancer, but because a constant low level of cancer is essential to human longevity, the cure will reduce the human lifespan to 35 at most. Fortunately, the genetic engineers will also learn how to transmit knowledge with viruses, so that children can be given speech while they are still babes in arms and can take up trades well before puberty. At the age of ten, the kids are "Read" by the Consensus, a genetically engineered neural mass that then simulates the kid's mind within its tissues. Since the Consensus thus contains everyone in England (and others, with the ability to merge into a World Consenses, contain the people of other lands), it can efficiently consult everyone, or their simulated representatives, when making decisions. The result is a benevolent tyranny, constructed along Marxist lines, that seems to work quite well. It might work better if the Consensus did not use viruses to "cure" people of their quirks (including neuroses, psychoses, and other misfittings) only *after* their Readings.

Perhaps because the Consenses is a consensus of ten-year-olds, Ryman largely ignores the large proportion of the populace that is in its twenties and early thirties. His world is run by, dominated by, children with the minds of adults. And while this fits, and while it permits some satire of present governments run by adults with the minds of children, it does feel to me like a weakness in the tale. To my mind, verisimilitude insists that older, more experienced citizens play a greater role.

But set that aside. The tale itself centers on Milena, an orphan who seems to be immune to the viruses of education and social programming. (Indeed, she has the power to rewrite the viruses' DNA and turn them into adjuncts to her memory, though not necessarily adjuncts she can tap at will; many of her earlier memories seem to be gone.) She is an actress until she meets and loves Rolfa, a Polar Bear (a human genetically engineered to thrive in Antarctica) who loves opera, composes music, and is strongly at odds with her family, which wants her to give up her arty nonsense and get to work in the South Polar mines. In due time, the family wins and Rolfa is Read, cured, and off to a productive life. But she has left behind a

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copy of Dante's *Divine Comedy* that she has set to music.

When Milena finds the book, she resolves to get it performed despite its length and complexity and despite the fact that it is—unheard of heresy! —something new, outside the accepted canon of Shakespeare and Bach and other classics. The rest of the book is told in the form of scattershot memories, of the machinations that went into ensuring the performance in the form of holograms in space to be viewed from the ground, of enmities, of a recaptured childhood, of genetic fluctuations, of renewed cancer and hence age, of the Consensus's ambitions for interstellar contact, and finally of an apotheosis of freedom that produces a Child Garden indeed.

The world and Milena's life come effectively alive, and I quibble if I insist that walruses are arctic, not antarctic, that memory doesn't seem to be a matter of DNA, that . . . It may be a more serious flaw that the reader never really gets a decent sense of the production of Rolfa's Dante. But then, that production may be beside the point of a book that itself seems modeled on the *Inferno* and *Purgatorio*.

As I said, it's ambitious. So read it.

Pamela West's **20/20 Vision** may strike you as confusing. West plays with the paradoxes of time travel in a very matter-of-fact way. Give her a chance, and the picture will gel sufficiently to leave you with a story that is quite interesting and satisfying enough.

The tale begins in 1995. Amanda Zephyr, a music student, is murdered. The description lets the reader think that the killer is her cello teacher.

Jump now to 2020, when Max Caine, the detective who found the body, is putting his files in order in preparation for retirement. We learn that the killer was never found and the case went into the annals of idyllic Shawneeville's few unsolved crimes.

Jump to 2040, when police archivist Eloise ("Eel") Lacoste is prepping old cases for the records. Amanda's murder pops up as a potentially perfect crime; if detective Clay Adams cannot solve it at this late date, it will go down as high criminal art. But Adams has a knack for solving such ancient crimes —immediately he suspects Caine—by using technology to project suitable psyches into the past and nudge suspects and detectives in appropriate directions. Together, he and Eel try to lay a guilt trip on Caine and make him confess. They fail, but now the case records have changed; they suspect Caine not of the murder but of tampering with evidence. They try again, and this time Caine meets the genetically engineered wunderkind that Eel once was. The young Eel uses the local university's computer, paired with her own computer game, to project Caine back to 1995 in search of additional clues. He finds a hint and returns to gain another, and then another. In 2020, he and Eel track down surviving suspects, interview them, and arouse the villain's suspicion. Eel is kidnapped. Caine makes it back one more time on his own, and . . .

I found the technology of temporal consciousness projection hard to swallow, and I thought that West's future of 2020 and 2040 were not sufficiently distinguished from each other or from 1995 (and, indeed, our present). But still, *20/20 Vision* offers a unique vision of a reality that is fluid, changeable, as revisable as a story in the hands of a writer, or perhaps as a game whose crisis points can be played over and over again until one gets it right. The result, despite the flaws, is fascinating.

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Margaret Wender Bonanno's **The Others** strikes all the standard notes —male and political chauvinism, overpopulation, environmental destruction, whale killing, and more—in its condemnation of human irrationality. Yet, though it has to struggle a bit, it does rise above the level of cliche.

The scene is a world occupied by two species. One, the Others of the title, arrived some 500,000 years in the past, settled an archipelago, and slowly learned to surmount their passions—both the negative, which lead to violence, and the positive, which can lead to the negative—as they developed a civilization of remarkable sanity. They enjoy an advanced technology, zero population growth, intensive recycling, long lives, and equality of the sexes. They also have pointy ears and blood of different hue.

The second species, the People, native to the world, is riotous, brawling, prone to murder, torture, and exploitation of each other, very human. It is also on the verge of setting out in sailing ships to prove the world is round. The Others recognize that contact is inevitable and have long sent representatives, Monitors, to dwell in disguise on the mainland, learning all that can be learned in hope of preserving the Other kind and its civilization.

Contact comes. The nonviolent Others offer the natives their technology and boost them from squalor to an equivalent of our 21st century. Peace reigns. But then the native racial purists gain power, persecute the Others, and embark on a campaign of extermination.

The last of the Others survive for awhile in the ruins of their cities. Now meet Lingri, the Other kind's lone poet, assigned by her people to write a chronicle of the two species and their relationship as seen through her own eyes. She writes in her hidden room while the People's thugs destroy her kind; what she writes is this book, full of characters with whom one can empathize. Lingri tells of her experience as a Monitor, her presence at first contact, her friendship with a woman of the People, her alien mate, her hybrid son. In the process, she both reveals the People's better qualities and shows that the Others too can be short-sighted, proud, vain, and violent. Civilization is a struggle, albeit one well worth the effort.

Is there a solution—other than extermination of the eternal Other—to the conflict? Bonanno ends her tale with the suggestion of an isolated refuge elsewhere on the planet. But this only staves off the inevitable. The People are bound to find the Others once more. If they are to enjoy more than a temporary respite, it can only be because flight offers time for the People to mature a little more.

The laudatory quotes attached to T. A. Barron's **Heartlight** were so remarkably fulsome that they nearly kept me from opening the book. The author would probably be happier if they had succeeded, for though this book for younger readers has its points, it is far too New-Agey crystal-mystic to appeal to any youth whose science background includes more than one or two PBS specials. Nor is it likely to encourage a career in science.

Kate is visiting her grandfather, a once-famous octogenarian scientist with a tendency to lock himself in his backroom lab. As soon as Barron establishes that Kate and coot are both endearing, he reveals that the coot is on the track of great secrets: Pure condensed light! The sun is dying! The star Trethoniel, most beautiful in the universe, staving

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off its death the longest, may have the secret! And look, if you pour a little PCL into this specially conductive, butterfly-shaped ring, it will turn you into heartlight. You can then whisk off to Trethoniel and learn how to save old Sol. No! Not you, but grandpa, despite his promise to stay home, despite the collapse that was obviously a heart attack.

As soon as Kate fights off the ghost who seems to want the PCL and finds the second ring, she follows grandpa, riding on a talking butterfly, meeting talking crystals and a Darkness, a serpentine demon that erupts from Trethoniel to praise immmortality and greed and deny the fitness of the Pattern that gives to each thing its own time and place. The Darkness tries to kill Kate and to persuade grandpa to give it his heartlight (which can only be given freely, not stolen). Kate learns what is really going on from the crystals and tries to stop the transaction. And then . . .

You, like me, can surely predict the rest. The tale is quite classic in its form, even in the character of the maligned and doddering super-scientist. It is also quite classic in its lack of respect for real science and scientists.[2] Yet the tale does have value in the way it encourages an unselfish attitude toward mortality and an acceptance of other beings. For such things, we can forgive it its sins even if we can't recommend it for any youth with some sense of what the real world is like, or to any parent who wishes to encourage such a sense. ■

[2] You should only see what Barron does to his Hawking figure!

●It is a maxim among lawyers that whatever hath been done before may legally be done again; and therefore they take special care to record all the decisions formerly made against common justice and the general reason of mankind. These, under the name of *precedents,* they produce as authorities to justify the most iniquitous opinions; and the judges never fail of directing accordingly.

Jonathan Swift

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brass tacks

Dear Dr. Schmidt:

As the "unnamed reader" who pointed out to Tom Easton that *Men Like Rats* was based on the same theme as the classic by William Tenn, *Of Men and Monsters*, I would like to hasten to point out that (1) I did not grumble and (2) I most certainly did not accuse Rob Chilson of plagiarism.

My purpose was simply to give credit to the late Mr. Tenn, whose superbly well-crafted stories introduced me to science fiction, and who I believe is a very underrated author. I believe he deserved a niche up there with the other greats of his era.

As Mr. Easton points out, it is ludicrous to accuse an author of plagiarism for borrowing a general theme or concept from an earlier work, particularly in science fiction. If this were not the case, then virtually every time travel novel over the last 50 years would have to be a "plagiaristic rip-off" of H.G. Wells! One of the best examples of this borrowing was a novel that appeared in *Analog* a few years back (*Dawn*, by Dean McLaughlin) which described the effects of the first total eclipse with complete darkness in centuries on a planet in a multi-star system. Of course, every *Analog* reader immediately recognized Dr. Asimov's legendary *Nightfall*, but this did not detract from a very pleasant and exciting novel.

For the record, after reading Mr. Easton's review, I went out and bought *Men Like Rats*, read it, and enjoyed it immensely. Aside from the general concept, it has nothing whatsoever in common with Tenn's earlier work, and obviously does not represent plagiarism in any sense of the word. If Mr. Chilson chooses to expand the theme and write a sequel, I will be right up there in the line waiting to purchase a copy.

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S. J. ROSENBERG, M.D., F.A.A.N.
Orlando, FL

Dear Dr. Schmidt,

I take strong issue with your editorial in the July issue. I do not challenge either your competence as an editor nor do I fault your product. I do challenge that anyone has a "right" to make a mistake.

If a ship's captain has a collision at sea, he is in deep trouble. No mitigating circumstances are allowed. The fact that the captain was not even on the bridge is not an acceptable excuse. If I, as a licensed engineer, were to design something that causes injury due to faulty design, I am in trouble. A faulty computer program purchased from a reputable vendor is not a valid excuse. If your magazine loses readership because the stories are devoid of reality, you should be in trouble with your publisher. You are accountable for your results, not your efforts. The management gurus call this "management by objective" (MBO). Everyone else calls it "accountability." My specific complaint with your editorial is that it gives the impression that mitigating circumstances lessen your accountability.

Concerning specific stories: "Sparrow Hawk" addressed genetic engineering and "nanotechnology." I can envision an engineering project where such designs do not violate any structural or heat transfer laws, except that I would start from scratch instead of from naturally occurring biotissue. If a sizable proportion of the readership had their enjoyment of the story interrupted by perceived violations of physical law, then the story failed, and no apology is acceptable. It didn't work. On the other hand, "Naught for Hire" contains innumerable scientific flaws, yet is one of the most enjoyable stories I have read in some time. It worked.

WILLIAM R. MELGAARD
Hampton, VA

It worked for you, and me, and a lot of other people—and did not work for a sizable number of others. The same story can (and practically always does) work for some readers and fail for others; there's no contradiction in that because of the peculiar nature of the interaction being described.

As for your problems with the editorial, I don't think the one you're arguing with is quite the one I wrote. If I were to attempt to summarize my main point in a few words (always a risky proposition!) I'd say it was that different kinds of accountability are appropriate in different circumstances. Your ship captain, for example, is quite a different situation from a high school physics student doing his homework; you as an engineer authorizing actual construction are quite different from a group of your colleagues in a brainstorming situation. If you seriously hold that everyone is always absolutely accountable for every action, then we're all *in deep trouble!*

Dr. Schmidt,

Dr. Forward's "Negative Matter Space Drive" in the August *Analog* inspired me to look under the hood myself. I agree that the concept offends neither conservation of mass (energy) nor conservation of momentum. But may I suggest some improvements?

Dr. Forward's device depends on being balanced between mass and negamass. If it had *any* mass, positive or negative, even one extra proton, it would tend to remain at rest. Being massless allows it to wander as it pleases. Newton's famous f = ma is satisfied for any acceleration as long as

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force and mass are zero. Movement while unbalanced requires keeping the center of mass still, deforming the ship, and traveling light-years with a small unbalance would stretch the ship a great deal (read miles.)

One might think that a proton shouldn't make a difference when dealing with such huge forces. But what the drive actually does is apply net zero force to a net zero mass. Under these conditions, a proton weighs very much indeed. The mouse (ship) cannot drag the moose (proton). This can be fixed by kicking off particles now and then. But this isn't the biggest problem.

F = ma is satisfied as long as f and m are *both* zero. Dr. Forward may be able to make m equal zero, but what if the Universe decides to interact with the ship, as in an atmosphere? The ship would be subject to Brownian motion. Or if it hit a dust mote at near lightspeed. The dust won't budge. The ship will rebound! What ship could take the stress?

This doesn't mean that the concept is untenable. It just needs some tuning. I would suggest that Dr. Forward not be so stingy with the rocket fuel. If he would reduce the mass, not eliminate it, he could make a suitable rocket. Imagine a 100 kg rocket with 500 metric tons of fuel aboard. And an equal amount of negafuel to spew out the front. This would adjust the mass. You need significant ballast in an atmosphere, but in deep space and desperate conditions you could reduce to a few grams, allowing you to accelerate quite rapidly.

One other comment on the article. The 'if it can, it will' law was applied in a backward fashion. Instead of saying "because there is no law against negamass, it must exist," it should be "if we don't see negamass, there must be a law against it." After all, the reason we say "momentum is conserved" is because we've never seen it not conserved.

Thank you Dr. Forward, it will certainly be interesting if negamass exists. I would like to go for a ride.

DAVID B. GRAHAM

Pittsburgh, PA

Dear Dr. Schmidt:

As usual, I enjoyed the August issue of *Analog*. However, I was disappointed by the quality of the science in both Dr. Forward's science fact article on negative matter and the special feature by Arthur C. Clarke. Newton's Third Law will not yield so easily as these authors think.

Dr. Forward apparently has not considered the instability of negative matter at rest. As he points out, negative matter loses energy as its velocity increases, releasing an infinite amount of energy as its velocity approaches the speed of light. Thus, if negative matter could exist, it would be stable (i.e., in its lowest permitted energy state) only when traveling at the speed of light. Furthermore, in reaching this velocity, it would release an infinite amount of energy, which could be expected to significantly affect the nature of the surrounding Universe. Therefore, I would prefer that Dr. Forward not experiment with negative matter within this Galaxy. Nuclear fission, nuclear fusion, and even matter-antimatter annihilation are minor league energy sources in comparison to simply permitting even microscopic quantities of negative matter to accelerate from rest.

Fortunately for the stability of the Universe, negative matter cannot exist. If negative matter could exist, the same type of quantum mechanical "vacuum fluctuations" that permit matter to es-

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cape black holes (see pages 105 and 106 of *A Brief History of Time* by Stephen Hawking) would produce matter-negative matter pairs in such abundance that the energy release from the acceleration of the negative matter would destroy the Universe as we know it. Since the Universe is still here, negative matter must be forbidden.

Arthur C. Clarke's representation that Mexican jumping beans violate Newton's Third Law was also entertaining but misleading. Like grasshoppers, kangaroos, or human high jumpers, the Mexican jumping bean transfers momentum to the earth when it jumps, in full compliance with Newton's Third Law. A Mexican jumping bean that is not in contact with a surface to which it can transfer momentum can't jump!

I hope that Dr. Forward and Arthur C. Clarke have better luck with their next far out ideas and/or April Fools Day columns.

Keep up the good work, Dr. Schmidt; I do enjoy your magazine.

JOHN W. HOCKERT

Of course Clarke's Mexican jumping bean was entertaining but misleading —that's exactly what it was intended to be! Humor virtually always has to take some liberty with the truth, and this article was in the spirit of our "Probability Zero" features—the very essence of which is a story that sounds plausible until you think about it hard enough to see the flaw.

As for negative matter, the author replies . . .

Dear Stan,

Both Hockert and Graham need to read my much longer and much more rigorous paper published in the AIAA *Journal of Propulsion and Power*.* I am sending them a copy of this letter.

First, let me assure everyone that I doubt very much that negative matter exists. The only reason I wrote the *Journal of Propulsion* paper and the *Analog* article was because I couldn't *prove* that negative matter does not exist by logical arguments based on classical mechanics.

John Hockert does not have the correct picture of the behavior of negative matter. First of all, negative matter at rest stays at rest, unless it interacts with normal matter. Thus his scenario of negative matter releasing an infinite amount of energy as it accelerates to the speed of light is not correct. He is also not correct in his picture of the vacuum producing normal matter-negative matter pairs in abundance. There is no reason why there should be a "pairing" normal matter particle for every negative matter particle. If Dr. Hockert reads my original paper, and then *still* finds an objection, I encourage him to write a scientific paper refuting my paper rather than jot off a poorly thought out letter to *Analog*. If he is right, and can prove that negative matter does not exist, I will be the first to congratulate him.

David Graham is correct that an excellent way to use negative matter is to use it to decrease the inertial mass of your ship so a small rocket can propel it very rapidly. I encourage him to analyze it in detail and publish a paper. Perhaps he can find a problem with that scenario that would prove negative matter is logically impossible. He is not correct that my device depends upon exact balance between positive and negative mass. If he will carefully read the original paper I am sending him, he will find that the negamatter drive *will* work with unequal masses, it is just that you have to reset the spacing between the masses periodically.

As for the "unwritten law of physics" that "If something is not forbidden, it is compulsory," I don't believe

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in that either. I do, however, use it as an aid in looking for new physical phenomena that others have not yet seen, or have seen and misinterpreted.

DR. ROBERT L. FORWARD

* P.S. If you want a free copy of "Negative Matter Propulsion," send a long self-addressed stamped envelope with 45 cents postage to Forward Unlimited, P.O. Box 2783, Malibu, CA 90265 USA.

Dear Editor:

I have always thoroughly enjoyed *Analog* and the quality of writing it promotes. However, a recent phrase in "Adam and Evil" disturbed me.

When talking about the prince's tactile device which allowed him to see, the author stated: "where once he would have spent the rest of his life groping about with a white cane or following a guide dog . . . " I feel that this statement is an expression of the author's insecurities and misconceptions about blindness. What is ever more frustrating is that he is writing these inaccuracies for others to read, and therefore enhancing misconceptions on his readers' part.

I am a white cane user, and I do not "grope about." I have received skills and training in the use of a white cane, and can travel freely by using the cane as a mobility tool. "Groping" is something that happens to sighted people when the lights go out, not to blind people.

Analog is one of the publications which is put in disc form, and distributed by the Library of Congress to blind readers. We'd like them portrayed as they are: independent and capable. After all, the author is simply an accident away from joining us, don't be too quick in using degrading terminology.

YOLANDA L. THOMPSON

Las Cruces, NM

Dear Mr. Schmidt:

Thirty years a reader, first letter. There is a question for US citizens that I have not seen publicized.

Because explorers/colonists will need weight for health for many years yet, the Moon and L5 are logical first steps. Space stations need economical planetary support. So the Moon colony is the logical next step. Why is there a resounding silence about Moon colonies from the space exploring powers-that-be? The answer is necessarily speculative. Mine is an indignantly suspicious suggestion:

Between two great powers, a Moon colony would have to be cooperative; or two colonies would make the Moon a bone of strategic contention. Likely there is a secret treaty that has arranged to leave lunar development in the Too Hard basket. Eh?

Indeed, a lunar colony with independent life support, and a mass driver, would be a complication in Earthly grand strategic calculations. Is it being suppressed, and if so, should it be? The US press, led perhaps by *Analog*, has a duty to stir this one up about now; if only to maintain your prestige amongst we of the older cultures, who understand terran history and cheer on the US Constitution. (And hurrah for the Hubble Telescope!)

GLEN BOWMAN

Australia ■

●All great truths begin as blasphemies.

George Bernard Shaw

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a calendar of analog upcoming events

28-31 March
NORWESCON 14 (Seattle area SF conference) at Sheraton Hotel, Tacoma, Wash. Guest of Honor—Stanley Schmidt. Fan Guest of Honor—Becky Thomson. Registration —$30 until 1 March, $35 at the door. Info: Norwescon 14, NWSFS, Box 24207, Seattle WA 98124. (206)248-2010.

29 March-1 April
SPECULATION (42nd British National SF Convention) at Hospitality Inn, Glasgow, Scotland. Guest of Honour—Robert Holdstock. Registration—£20 attending, £10 supporting. Info: Speculation, 35 Buller Road, London N17 9BH, England, UK.

12-14 April
TECHNICON 8 (Virginia area SF conference) at Donaldson Brown Center, Virginia Tech, Blacksburg, Virginia. Writer Guest of Honor—Diane Carey & Greg Brodeur, Artist Guest—Ruth Thompson, Additional Guest—Don Sakers, Fan Guest of Honor— John McMahon. Info: Technicon 8, % VTSFFC, Box 256, Blacksburg VA 24063-0256. (703)953-1214. Technicon@VTCC1/cc/vt/edu [Internet]; Technicon@ VTCC1.BITNET [Bitnet]; The Tardis@ 1:264/711 [Fidonet].

19-21 April
AMIGOCON 6 (El Paso area SF conference) at the Sunland Park Holiday Inn, El Paso, Texas. Writer Guests of Honor—L. Sprague and Catherine Crook de Camp, Artist Guest of Honor—Alan Gutierrez. Registration—$15 until 12 April, $17 thereafter or at the door ($6 Friday, $8 Saturday or Sunday). Info: Amigocon 6, Box 3177, El Paso TX 79923.

19-21 April
I-CON X (Long Island area SF conference) at S.U.N.Y., Stony Brook, N.Y. Guests—Poul Anderson, Hal Clement, Harlan Ellison, Frederik Pohl, Jack Williamson. Registration —$20 until 31 March, $25 at the door. Info: I-Con X, Box 550, Stony Brook NY 11790. (516)632-6460.

27-28 April
Boise Fantasy Arts Convention. Info: BFAC, Box 8602, Boise ID 83702. (208)454-2835.

29 August-2 September
CHICON V (49th World Science Fiction Convention) at Hyatt Regency, Chicago, Ill. Guest of Honor—Hal Clement; Artist Guest of Honor—Richard Powers; Editor Guest of Honor—Martin H. Greenberg; Fan Guests of Honor—Jon & Joni Stopa. Registration —$110 until 31 March 1991. Supporting—$20 at all times. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Join now and get to nominate and vote for the Hugo Awards and the John W. Campbell Award for Best New Writer. Info: Chicon V, Box 218121, Upper Arlington OH 43221-8121.

8-14 September
VOLGA-CON (International SF convention on the Volga). Sponsored by SF Club "The Winds of Time" and the Youth Association ATOM. Info: Volga-con, % Boris A. Zavgorodny, Volgograd-66, Poste restante, 400066 USSR. Telephones: 34-74-62, 34-74-64, 34-44-09, 34-86-56.

—Anthony Lewis

Items for the Calendar should be sent to the Editorial Offices six months in advance of the event.

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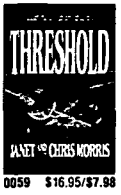

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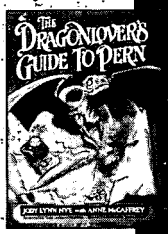

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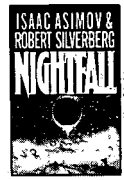

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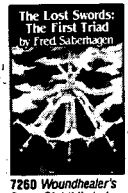

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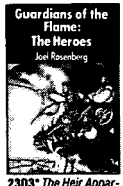

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